

# NEPAL ELECTRICITY AUTHORITY

(An Undertaking of Government of Nepal)  
Distribution and Consumer Services, East  
PLANNING AND TECHNICAL SERVICE DEPARTMENT



**ENERGY ACCESS AND EFFICIENCY IMPROVEMENT PROJECT**  
**ADB Loan No.-2587 NEP (SF)**

**KATHMANDU VALLEY & BIRGUNJ-SIMRA CORRIDOR DISTRIBUTION SYSTEM  
REINFORCEMENT AND LOSS REDUCTION PROJECT**

**DRAFT BIDDING DOCUMENT  
FOR  
SUPPLY AND DELIVERY OF VARIOUS LINE MATERIALS AND  
INSTALLATION OF LINES (Package D3)**

**Procurement of Plant  
(Design, Supply and Install)  
Single-Stage, Two-Envelope Bidding Procedure**

**Section VI: Technical Specifications and Drawings  
(Volume II of III)**

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on the hard copy to be purchased from the Project Office.**

**January 2013**

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**SECTION VI**  
**TECHNICAL SPECIFICATIONS**  
**&**  
**DRAWINGS**

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**Section VI-A**  
**STANDARD SPECIFICATIONS**

## SECTION VI-A : STANDARD SPECIFICATIONS

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**1. General**

- 1.1 These Standard Specifications, together with the Construction Standards, shall govern the performance of the Works and shall be the basis for inspection and acceptance of the Work by the Project.
- 1.2 The Standard Specifications and the Construction Standards shall be considered as mutually inclusive, and the conditions stated in each shall supplement the other as appropriate.
- 1.3 All Standard Specifications shall be followed at all times by the Contractor unless specifically accepted in writing by the Project, or unless some aspects of the work covered by these General Specifications are not required by the Scope of Work.

**2. Route of Circuits**

- 2.1 To the greatest extent practicable, all overhead circuits should be located along streets or travelled ways ordained by the Municipality & Village Development Committee or required authority as public property, except as required for Service drops and circuits to individual consumers.
- 2.2 To the greatest extent practicable, all facilities should be located on public property, and in no case shall private property be occupied unless specifically authorized by the Project. The Project shall obtain any required permits for occupancy of public or private Right-of-Way, pursuant to Section IV Clause 8.

**3. Survey and Staking**

- 3.1 All structures should be located at the outer limits of public property along streets or travelled ways. Structures should also be located along streets at property lines of adjacent private property. Structures and stays running parallel or perpendicular to the line route shall not block portions of streets, travelled ways, drives, passages, or gates.
- 3.2 All structures shall be so located as to reduce, to the greatest extent practicable, obstacles to pedestrian and vehicular traffic. Barriers shall be provided in accordance with instructions by the employer. As far as practicable, transformer structures shall be located to reduce visual and noise impact on adjacent residences or businesses.
- 3.3 Where underground facilities are indicated by surface conditions, or where such facilities can be located, structures and stays shall be so located as to avoid conflict with such facilities during construction.
- 3.4 All structure and stay lead locations shall be staked. At points of Intersection (P.I.) of tangent line sections, steel rebar stakes shall be used to locate the P.I. A minimum of two (2) side sightings will be made at each P.I to permit re-location of P.I. in the event of stake removal. All structure locations in tangent line sections shall be staked.

- 3.5 All distances between structures, and other necessary measurements of length, shall be measured to accuracy, of 0.1 metre and all angles shall be determined by transit to an accuracy of 0.1 decimal degree. All elevations shall be measured to an accuracy of 0.1 metre by means acceptable to the Project.
- 3.6 All measuring and staking activity shall be accomplished by personnel with experience in survey procedures, and standard survey equipment acceptable to the employer, shall be used to perform the survey work. Field survey notes covering all survey work shall be produced and maintained and shall be turned over to the Project at the time of completion of the Works. The format of proposed survey notes shall be submitted to the Project for approval.
- 3.7 Survey work shall include centre line and structure location and staking; determination of overhead and side clearings of other structures, wires, and obstacles; area surveys and plotting; and centre-line profiles of terrain; as directed by the Project.

#### **4. Technical Documentation**

- 4.1 All technical documentation as specified herein, shall be prepared by the Contractor. The Contractor shall employ skilled drafting personnel to produce all documentation specified. All technical documentation prepared by the Contractor shall be subject to the approval of the Project prior to acceptance by the Project of such documentation. All technical documentation shall be prepared in the English language.
- 4.2 Documentation shall be prepared using the following mediums:
- a) Mylar material, with a minimum thickness of 0.127 millimetres, shall be used to produce the base Structure Data Sheet, As-Built Drawings and other drawings specified by the Project.
  - b) Standard drafting vellum shall be used to produce small area plottings, profiles of line-sections and centre-line plotting necessary for the development of Structure Data Sheets and As-built Drawings.
- 4.3 Structure Data Sheets (SDS) shall be prepared in accordance with the F1 format contained in Volume 2, Section X. Structure Data Sheets shall be prepared by the Contractor showing his proposed construction details for erection of facilities in accordance with the Construction Standards. The SDS shall be prepared after the centre-line survey and staking is completed, for any line section designated by Project, and shall be submitted to Project for approval prior to any construction of the facilities shown in SDS. Submission of SDS for approval shall be in the form of A3 photocopy in clearly legible copy. Any unclear or illegible form entry or reproduction shall be rejected. Project may require any revisions to be made, at their sole discretion, prior to approval of the SDS for construction. An approved and field checked SDS is required for all Construction Units invoiced by the Contractor. Field checking of the SDS shall be performed jointly by the Contractor and Project representative. The SDS and As Built Plan are intended as permanent records for Project. Any construction performed prior to the Contractor's receipt of approved SDS from Project shall be completely at the

Contractor's risk, and Project shall have the right to require any correction due to the unapproved construction activities.

- 4.4 As-Built Drawings shall be prepared by the Contractor in the general format provided by the Project. Drawing size shall be approximately 841 x 597 mm overall and the scale shall be 1:10,000, 1:2,000. The Project shall provide any available environmental background data for inclusion on the various drawings and the Contractor shall record (in ink) all facilities as-built.
- 4.5 The Contractor shall prepare other technical drawings, in the same medium and format as the As-Built Drawings, for As-Built Drawings index sheets, pole maps, and One-Line Diagrams as specified and required by the Project.
- 4.6 The Contractor shall and prepare and furnish Transformer Record documents, in the format specified by the Project, for each transformer installed.

## **5. Material Storage**

- 5.1 The Contractor shall procure all materials and equipment except Distribution Transformers, HV Covered conductor, LV ABC Cable and Insulators/Hardwares which are furnished by the Project for the work from the Project warehouse. The Contractor shall provide all labour, equipment, and vehicles to load and transport said materials and equipment to the Contractor storage facilities and worksites as required. All materials and equipment turned in to the Project reclaimed after demolition of existing facilities if any shall be transported to the Project warehouse and unloaded in the same manner.

### **5.2 Worksite**

- a) Extended storage of materials along the routes of lines will not be permitted. All small items of material shall be provided to the work crews on a daily basis and no small items of materials may be stored on the worksite overnight.
- b) Transformers, ABC cable and conductor reels may be spotted at the worksites for a short period prior to installation provided that crating and reel lagging are intact to protect the items. Poles may be spotted at structure locations for short periods prior to setting.
- c) All poles, transformers, ABC cable and conductor placed at the worksites shall be located so that the items are not subject to damage and do not impede pedestrian or vehicular traffic.
- d) Any damage caused by imprudent placement of equipment and materials by the Contractor at the worksites shall be corrected by the Contractor, in a manner acceptable to the Project, at the Contractor's cost.

### **5.3 Contractor Storage Facility**

- a) The Contractor shall be financially responsible for the secure and proper storage of materials, which are to be provided by the Project prior to installation of the materials and equipment, to prevent loss or damage to any materials.
- b) Any items of material and equipment contained in degradable packaging shall be stored under roof and protected from moisture. Other materials, except as specified in subparagraph (c) below shall be stored and covered in a well-drained level area, free from accumulation of surface water.
- c) Transformers, disconnecting switches, and reels of ABC cable may be stored outdoors in a well-drained, level area free from accumulation of surface water. Reels of ABC cable may be stacked on reel sides not more than three (3) reels high. ABC cable reels shall be placed on Wood pallets, wood lagging, or well-gravelled level surface.
- d) Packaged items of material and equipment shall not be uncrated, or have packaging removed, prior to installation. The Contractor shall exercise due caution and care in the transportation, storage, and handling of all materials which are to be provided by the Project. Equipment consisting of, or containing, porcelain insulation should be transported and handled to avoid cracks or chipping. Lagging or other protection, shall not be removed from ABC cable reels until the cable is to be installed.
- e) The ends of installed cables shall be sealed immediately after being cut with a non-absorbent covering fastened around the outer jacket.

## **6. Excavations**

- 6.1 All excavations made for the installation, or demolition, of facilities shall be accomplished in a timely manner according to the scheduled installation. Required excavations shall be opened, material installed, and backfill placed, as specified, in a continuing operation to the greatest extent practicable.
- 6.2 Any excavation left open during discontinuous construction which is accessible to the public or along public thoroughfare, shall be covered or barricaded, and marked by suitable visual means, to prevent a public hazard.
- 6.3 Excavations shall be properly located and sized for the intended use. Pole and stay plate/ anchor excavations shall be correctly sized to retain undisturbed soil to the greatest extent consistent with the means of excavation. Pole holes shall be made by power-driven auger or by manual methods; power-driven shovel equipment shall not be used. Pole holes shall be excavated to the specified depth with no tolerance shallow and tolerance of ten (10) centimeters deep. The bottom of pole holes shall be undisturbed soil, gravel or rock. Stay plate holes shall be excavated by manual methods to specified depth with no disturbed soil in the direction of the anchor rod.
- 6.4 All excavations shall be backfilled with excavated material, or as specified for the installation. Backfill shall be free of foreign materials and shall be well tamped with excess backfill graded over the excavated area to prevent depressions resulting from eventual natural compaction. Large amounts of excess backfill shall be removed from the

site by the Contractor if so directed by employer. If so directed by Project, The Contractor shall provide suitable backfill materials for excavations where existing removed materials is insufficient, or inappropriate, to provide suitable grading of the excavated area.

## **7. Pole Setting**

- 7.1 Poles shall be set in accordance with the appropriate Sections of the Construction Standards and subparagraph 6 above.
- 7.2 Each pole shall be assigned a unique construction number at the time of structure staking for preliminary identification and preparation of structure Data Sheets (SDS).
- 7.3 Subsequent to the preparation and approval of SDS, and prior to provisional acceptance of a given line section, the Project shall provide the Contractor with unique permanent pole numbers. The Contractor shall then apply the specified permanent pole numbers to each pole with black oil-based paint in neat clear English letters and/or Arabic numerals. Permanent pole numbers shall be applied in letters/numerals five (5) centimetres in height at a point on the pole 1.6 meters above ground level. Numbers shall be applied on the side of the pole facing the adjacent street or travelled way.

## **8. Safety**

- 8.1 The Contractor shall take all measures required to safeguard the public, public and private property from any hazard to life, limb, or property which may arise during the performance of the construction of the works. Such measures shall include, but not be limited to: barricades, signs, newspaper announcements, traffic control by police, or other advisory and control methods deemed appropriate.
- 8.2 The Contractor shall provide his work force with all tools and equipment in sufficient numbers and quality to perform all aspects of the works in a safe manner. The Contractor shall provide protective headgear for all members of his workforce, and shall provide protective clothing as required for specific tasks. The Contractor shall instruct his work force in proper and safe construction techniques and shall continuously monitor compliance with safety instructions throughout the period of the Contract.
- 8.3 The Contractor shall provide, and require use of, protective grounding equipment when:
  - a) Work is being performed on lines adjacent, either in extension of, or parallel to, energized circuits.
  - b) Work is being performed on isolated circuits after conductors have been installed.
- 8.4 The Contractor shall maintain all tools and equipment in good working order. All mechanized equipment shall have adequate safety mechanisms and guards in place and be fully operational. Operators of such equipment shall be skilled and fully trained in the operation of such equipment.

- 8.5 The Contractor shall provide and maintain emergency medical supplies to cover with accidents and snakebites for his work force on a readily available basis. The Contractor shall also instruct all supervisory personnel in the action to be taken in the event of serious injury, and the sources and locations of professional medical assistance which shall be employed in such cases.
- 8.6 The Contractor shall apply all accidental insurance policies to his work force for an accident occurring during the working period of the construction.

## **9. Tests**

- 9.1 The Contractor shall furnish the electrical test equipment and personnel to perform electrical tests of equipment and circuits, as specified by, and under the supervision of the Project.
- 9.2 The Contractor shall megger all circuits installed with a motor-driven megger or equivalent instrument to demonstrate the acceptable insulation characteristics of the line prior to energization and Provisional Acceptance. 11 kV overhead circuits shall be tested at 2500/1000 volts AC.
- 9.3 The Contractor shall megger all transformers with a motor-driven megger prior to installation
- 9.4 All tests specified shall be conducted during suitable atmospheric conditions under the supervision and witness of the Project. All test results shall be documented and signed by both parties.

## **10. Demolition**

- 10.1 The Contractor shall perform the removal of all existing facilities, if any, in accordance with the specific directions of the Employer. All materials removed shall remain the property of Project and the Contractor shall deliver all salvaged materials to the Project warehouse, or as specifically directed by the Employer.
- 10.2 All poles shall be removed by pulling the complete pole from the ground; poles shall not be cut off at the ground line. Holes shall be backfilled and compacted completely with sufficient added backfill piled above grade to prevent depressions being created by natural compaction. Backfill material shall be provided by the Contractor.
- 10.3 All conductor materials removed shall be returned to the Project. Methods of conductor removal shall be specified by the Project. If conductor is removed in the longest length practicable for future re-use, the said conductor shall be wound on empty conductor reels, with the reels marked with the conductor size and approximate length. Different conductor sizes shall not be mixed on any reel. If conductor is removed from structures and specified as scrap, conductors may be cut down in lengths and made up in rolls. Conductor sizes for scrapping may be mixed; different conductor metals shall be separated.

- 10.4 Care shall be taken in removing, handling, and transporting cutouts, and surge arresters to minimize porcelain damage.
- 10.5 Transformers removed from service shall be delivered to the Project warehouse or as specifically directed by the Employer. Care shall be taken in removing, lifting, and transporting transformers.
- 10.6 Other structures shall be removed, such as concrete transformer pedestals in the most appropriate manner, as specified by the Project. Existing stay rods may be cut 20 centimetres below finished ground level.

## **11. Cleanup**

- 11.1 The Contractor shall ensure that all worksites shall be free of all manner of debris resulting from the construction activity.
- 11.2 All crating, ABC cable and conductor reels, packaging materials, conductor scraps, and other miscellaneous items are removed from the workplace. All holes resulting from removal of facilities shall be filled. If trees or bush have been cut or trimmed, all cuttings shall be removed. The worksites shall be left in clean natural conditions.
- 11.3 Site cleanup shall be an integral part of the Provisional Acceptance process, and no line section shall be provisionally accepted unless all cleanup work has been accomplished.

## **12. Tree Cutting and Trimming**

- 12.1 Any tree cutting or tree trimming authorized and directed shall be accomplished by the Contractor under the direct supervision of Project.
- 12.2 All cutting shall be removed by the Contractor with disposition of cutting as specified by Project.

## **13. Interruptions to Existing Service**

- 13.1 The Contractor shall arrange for interruptions of service to existing lines with Project. Every effort shall be made to limit such interruptions to the minimum.
- 13.2 If it is possible to maintain service to a section of line by constructing temporary facilities approved by Project, the Contractor shall detail man hours and classification of personnel required to construct such facilities and submit to Project for approval prior to any work being performed. Payment for approved work shall be based on the rates covered in Construction Unit LR of Section VIII, Volume 2.



**Section VI-B**  
**CONSTRUCTION UNIT**

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<b><u>SL.No.</u></b>	<b><u>Subject</u></b>
1.	Structure Data Sheet (SDS)
2.	General Information
3.	Definitions of Construction Units
11-1	11 kV Supports, Insulators and Hardware
11-2	11 kV Conductor & Accessories
11-3	Switches and Cut-outs
0.4-1	0.4 kV Supports, Fittings
0.4-2	0.4 kV ABC Cable & Hardware
11/0.4	Transformer Installation
LR	Labour Rates

**STRUCTURE DATA SHEET (SDS)**

Structure Data Sheets (SDS) shall be prepared to provide details of specific construction information necessary for erection of pole structures with hardware and accessories and conductor installation. The SDS shall be used in conjunction with the area plan drawing to document the works to be performed.

Abbreviations used in the preparation of SDS shall be defined as follows,

<b><u>Sl. No.</u></b>	<b><u>Nomenclatures</u></b>	<b><u>Meaning</u></b>
a.	Pole Construction No.	Number assigned by the Contractor to identify pole on Plan drawing.
b.	Span	Length of conductor span between poles
c.	BK	Angle of line deflection in degrees
d.	Pole	Pole quantity
e.	Frame	The construction Standard Drawing No. for 11 kV system for which the pole is to be framed e.g. CS11-PSCP-05.
f.	Stay	The Construction Standard Drawing No. of stay to be installed in different voltage system, e.g., CSG-08.
g.	Transformer	The Construction Standard Drawing No. for which the transformer installation is to be framed e.g. CS11-TRN-02.
h.	Conductor	The number and size of conductors in sq. mm in 11 kV system, e.g. 3-120.sq mm.
i.	Conductor (km.)	Running km. length of conductor.

**Note :**

- Information for a single pole location need not be confined to a single row.
- All works, whether new or on existing systems, shall be documented on the SDS.
- Each SDS shall include the applicable "As Built" Plan Drawing number(s). Similarly each "As Built" Plan Drawing shall include the applicable SDS number(s).

## **DEFINITION**

### **GENERAL INFORMATION:**

This describes requirements of those items which have not been included in specific Construction Unit and which are of general nature.

1. All Construction Units shall include the cost of preparation, revision and reproduction of supporting Structure Data Sheets (SDS) .
2. All Construction Units shall include the cost of cutting and painting bolt ends extending more than 30 mm beyond nut if necessary. Paint shall be Local Material supplied by the Contractor
3. Construction Units 11-1 shall include the cost of preparing As Built drawing.
4. All construction Units shall include necessary cost for trimming and cutting of tree to clear route for new or existing works. Cutting of trees, at the earth line, shall be the responsibility of the Contractor but DSAP shall assist to obtain necessary permit for the same. But it does not mean the cutting trees of dense forest

**DEFINITION OF CONSTRUCTION UNIT 11-1****11 kV SUPPORTS, INSULATORS AND HARDWARE****REFERENCE STANDARD/SPECIFICATIONS**

1. Construction Standards : Section VI-D Clause 2
2. Purpose: Construction unit is for the installation of an 11 metre Pre-stressed Concrete pole for 11 kV overhead line structure with cross-arms, insulators and hardware fitting complete. Unit does not include installation of stay.
3. Activities : Procurement and transportation of materials to the site, excavate pole hole, set pole, if necessary, back fill and tamp poles, compact the back filling adequately, re-align, if necessary, install framing including insulators and hardware, provide and install local materials, if necessary, as designated by the material list.
- 4 Type of Frames:

Sl. No	Frame Type	Description	Construction Standard	
			PSC Pole Structure	Steel Tubular Pole Structure
1.	11-1.1	Single Arm Structure (SA)	CS11-PSCP-04	CS11-STP-04
2.	11-1.2	Double Arm Structure (DA)	CS11-PSCP-05	CS11-STP-05
3.	11-1.3	Tap Off Structure (TA)	CS11-PSCP-06	CS11-STP-06
4.	11-1.4	Dead End Structure (DE)	CS11-PSCP-07	CS11-STP-07
5.	11-1.5	Double Dead End Structure (DDE)	CS11-PSCP-08	CS11-STP-08
6.	11-1.6	Offset Structure (OS)	CS11-PSCP-09	CS11-STP-09
7.	11-1.7	H-Structure (HS)	CS11-PSCP-10	CS11-STP-10
8.	11-1.8	Transformer Structure (TR)	CS11-TRN-01 CS11-TRN-02	CS11-TRN-03 CS11-TRN-04

## **DEFINITION OF CONSTRUCTION UNIT 11-2**

### **11 kV CONDUCTOR & ACCESSORIES**

#### **REFERENCE STANDARD/SPECIFICATIONS :**

1. Construction Standards : Section VI-D Clause 3, 4 & 5

2. Purpose :

Construction unit is for the installation and stringing of XLPE Covered Conductor for 11 kV overhead lines. Unit is per single conductor running km.

3. Activities :

Transportation of materials to the site, set up wire stringing reels, pulling lines, stringing blocks on poles/cross-arms, install and remove temporary guard structures, if necessary, install and remove temporary structures to keep conductor from dragging on earth, if necessary, pull conductors, sag and dead end, remove conductor from stringing blocks, tie to insulators, make necessary compression joints, connect jumpers and complete installation.

4. Size of XLPE Covered Conductor

11-2.1 120 sq. mm XLPE Covered Conductor

### **DEFINITION OF 11 kV LOAD BREAK SWITCH**

#### **REFERENCE STANDARD/SPECIFICATIONS :**

1. Construction Standard:

2. Purpose :

Construction unit is for the installation of Air Load Break Switches according to the manufacturer's instructions. Unit does not include installation of pole.

3. Activities :Transport material to site from respective warehouse, make dead end, install Load Break Switches according to the manufacturer's instructions, install earth (earth) conductor with 1-rod, adjust Load Break Switches as per manufacturer's instructions, connect jumpers and complete installation.

## **DEFINITION OF 11 kV XLPE CABLE LAYING**

### **REFERENCE STANDARD/SPECIFICATIONS**

1. Construction Standards : Section VI-D Clause 8

2. Purpose :

Construction unit is for the installation of 11 kV armoured XLPE cable (300 mm<sup>2</sup>) for 11 kV underground lines. Unit is per three core cable running km.

3. Activities :

Transport materials to site from project's respective warehouse, excavate cable trench ( 90 – 140 cm height), lay cable inside the HDPE pipe along the trench and PPR pipe for rising cable at pole, provide and install local materials such as sand if necessary, back fill and tamp trench till adequate compaction is reached as per construction standard and as directed by the project engineer.

**DEFINITION OF CONSTRUCTION UNIT 0.4-2****0.4 kV ABC CABLE & HARDWARE****REFERENCE STANDARD/SPECIFICATIONS:**

1. Construction Standards: Section VI-D Clause 9

2. Purpose:

Construction unit is for the installation of LV ABC Cable for 400 volt overhead lines with ABC cable hardware fitting complete. Unit is per five core cable running km.

3. Activities:

Transport materials to site from project's respective warehouse, set up cable stringing reels, pulling lines, stringing blocks, install and remove temporary guard structures, if necessary, install and remove temporary structures to keep cable from dragging on earth, if necessary. Pull cable, sag and make dead end, remove cable from stringing blocks, tie to hardware, make necessary joints, mount connectors, make jumpers etc.

<b><u>Sl.No.</u></b>	<b><u>CU No.</u></b>	<b><u>Cable Size in sq. mm</u></b>	<b><u>Purpose</u></b>	<b><u>No. of Cable</u></b>
1.	0.4-2.1/3.1	3*95+1*95+1*16 sq mm	3 Phases, 1 Neutral and 1 Street lighting	5

**DEFINITION OF CONSTRUCTION UNIT 0.4-1****0.4 kV SUPPORTS****REFERENCE STANDARD/SPECIFICATIONS:**

1. Construction Standards : Section VI-D Clause 2

2. Purpose :

Construction unit is for the installation of 9 metre Steel Tubular Pole and Pre Stressed Concrete pole for overhead line structure. Unit does not include installation of stays.

3. Activities :

Procurement and Transportation of materials to site from respective warehouse, excavate hole, set pole, plant pole, provide and install local materials if necessary, back fill and tamp pole till adequate compaction is reached, realign the pole if necessary. Unit includes drilling of required holes of suitable size on pole if necessary.

Sl. No	Frame Type	Description	Type	Construction Standards
				9m Pole
1.	0.4-1.1	Suspension type	A1	Annex L
2.	0.4-1.2	Suspension with angle	A2	Annex L
3.	0.4-1.2	Suspension type with an anchor for dead	B	Annex L
4.	0.4-1.3	Four anchor dead end	C	Annex L
5.	0.4-1.4	One suspension with two anchor dead end	D	Annex L
6.	0.4-1.5	Single anchor dead end	E	Annex L

## **DEFINITION OF CONSTRUCTION UNIT 11/0.4**

### **TRANSFORMER INSTALLATION**

#### **REFERENCE STANDARD SPECIFICATIONS :**

1. Construction Standards

Section VI-D Clause 7

2. Purpose :

Construction unit is for the supply, delivery, installation of \*distribution transformer, platform cross-arms, insulators, dropout fuse cut-outs, lightning arresters, low voltage \*panel board, 11 kV jumpers, 400 V ABC Cable Hardware and earthing set complete including excavation and backfilling for earthing including installation of H-poles for support, LV panel and stays.

3. Activities :

Test the transformer with the right size of megger with respect to the primary and secondary voltage system, transport the transformer, lightning arresters, drop-out sets and distribution panel board, mount transformer on elevated platform, install LV cable between transformer LV terminals and protection panels, install all LV cables between protection panels and outgoing LV overhead lines, including cable and jumper connections, connect LV neutral earth terminal with earth lead. The Contractor shall procure all items specified in construction unit except Distribution Transformers.

\* Distribution Transformers are to be supplied by the project

**DEFINITION OF CONSTRUCTION LABOUR RATES****REFERENCE STANDARD/SPECIFICATION**

Purpose :

Construction unit is intended to use for such work which has not been defined by a Construction Unit. Contractor shall submit to the project, along with the bid, a written description of work which may have to be performed under certain situation and which were not foreseen during the design and study. This shall include location, number and classification of personnel to perform the work and estimated number of hours per man. This unit is to be charged only upon the approval of the project. Unit includes necessary transport of equipment to perform the assigned work.

<b><u>Sl. No.</u></b>	<b><u>Construction Unit</u></b>	<b><u>Designation</u></b>	<b><u>Rate per Day</u></b>
1.	LR-1.1	Engineer	
2.	LR-1.2	Supervisor or Foreman	
3.	LR-1.3	Lineman	
4.	LR-1.4	Helper	
5.	LR-1.5	Coolie	

**Section VI-C**

**SPECIFICATION OF CONSTRUCTION MATERIALS**

**GENERAL OPERATING CONDITIONS**

- |    |                     |                        |
|----|---------------------|------------------------|
| 1. | Ambient temperature | -5° C to 55° C         |
| 2. | Altitude            | up to 2000 m above MSL |
| 3. | Humidity            | 99% (max.)             |
| 4. | System voltage      | 11 kV, 400/230 V       |
| 5. | System frequency    | 50 Hz                  |

Note: The variation of frequency and voltage for design and operation is as per actual system operation i.e.  $\pm 5\%$ .

## SPECIFICATION: SP 1.1

### PRESTRESSED CONCRETE POLE

#### 1. **Scope**

These specifications apply to design, manufacture, and testing of rectangular pre-stressed concrete poles for use in electrical distribution.

#### 2. **Description**

- 2.1 The pre-stressed concrete pole shall be designed and fabricated in full compliance with IS: 1678-1978, or latest revision thereof or any other national or international standards that ensures at least equal or better quality to the standard mentioned above, will also be acceptable.

#### 3. **Load**

- 3.1 The working loads of various pole categories are given in Table 1. The design ultimate strength shall be calculated using a safety factor of 2.5. Pole Attributes are listed in Table 2.

#### 4. **Design**

- 4.1 The poles shall be as per following design parameters and the dimensions shall be as shown in Drawing. 1-4.

*Design Parameters:*

Concrete mix:	M400
Minimum diameter of pre-stressing wire:	7.9 mm (7/2.6mm) for 11m and 4 mm for 9m
No. Of pre-stressing wire:	8 nos for 11m and 4 nos for 9m
Working Load:	Refer Table 1
Depth of Plantation:	Refer Table 2
Point of Application of Load:	Refer Table 2

Further design details are given in Drawings.

- 4.2 The minimum strength of concrete in the pole shall meet the requirements laid down in IS:1343-1960 and IS:456-1964 or in any other equivalent national or international standards.
- 4.3 The strands shall be made from cold-drawn non-alloy steel (high carbon content) wires. The seven-wire strand consists of a group of wires arranged in stranded formation and

shall have the following properties. The seven-wire strands shall confirm to IS:6006-1983, or latest revision thereof or any other equivalent national or international standards.

*Geometrical Properties:*

	<u>11m</u>	<u>9m</u>
Type of material:	Seven-wire strand	Single strand
Minimum diameter of strand:	7.9 mm (7/2.6mm)	4 mm
Minimum cross-sectional area of strands:	37.4 mm <sup>2</sup>	12.56 mm <sup>2</sup>

*Mechanical Properties:*

Nominal mass of strand:	294 g/m	89.9 g/m
Minimum breaking load:	64.50 kN	21.54 kN
0.2% proof load	54.70 kN	

*Long Term Behaviour:*

Maximum relaxation after 1000 h of operation at initial load equivalent to 60%, 70% and 80% of breaking load shall not be higher than 1.0%, 2.5% and 4.5% respectively.

- 4.4 The pre-stressing strands shall be accurately positioned and satisfactorily protected against the formation of rust or other corrosion prior to the placement of the concrete. All pre-stressing strands shall be free from loose rust, dirt, grease, oil and other lubricants or substance that might impair their bond with the concrete.
- 4.5 The cement employed shall be the Ordinary Portland Cement (OPC), which shall conform to the chemical and physical requirements as set forth in BS: 12, or any other equivalent national or international standards.
- 4.6 The amount of concrete cover on the outside of the pre-stressed reinforcement shall be not less than 20mm.
- 4.7 The pole shall include cast-in holes. Typical hole patterns are shown in the drawings. Hole patterns must be confirmed with the NEA prior to manufacture.
- 4.8 All poles shall be unpolished but free of roughness, chips, excess cements, and other surface irregularities. All poles shall present a straight and symmetrical appearance after erection. The corners of all the poles shall be rounded so that they do not present a dangerously sharp edge, which could cause tearing or excessive wearing of safety belts.
- 4.9 All poles shall be provided with lifting hooks at two points for loading and unloading of poles.

**Table 1: Working Load**

<u>S.No.</u>	<u>Pole Length (m)</u>	<u>Design Load (kgf)</u>
1	9	200
2	11	350

**5) Tests**

*Definition of various types of loads:*

**Working load** = Expected Load

**Design Working Load** = Expected Load x Factor of Safety (FOS)

**Ultimate Transverse Load (UTL)** = Load when applied at specified point of the pole, the failure occurs.

**Minimum Ultimate Transverse Load (MUTL)** = Load when applied at specified point of the pole, the first crack appears.

**Design Transverse Load (DTL)** = Design Working Load

**Design Ultimate Transverse Load (DUTL)** = Design load at the transverse direction at which the first crack expected to appear (given by the Designer after calculation)

The **Design Ultimate Transverse Load (DUTL)** is less or equal to Ultimate Transverse Load

**5.1 Transverse Strength Test**

The pole shall be rigidly supported at the butt end for a distance equal to the specified planting depth. The load shall be applied at a point specified in Table 2 from the top of the pole and shall be steadily and gradually increased to the design transverse load until the occurrence of the first crack. The deflection is then measured. Prior to the application of the design transverse load there shall be no crack.

The load shall then be reduced to zero and increased gradually to a load equal to the first crack load plus 10% of the minimum ultimate transverse load, and held for 2 minutes. This procedure shall be repeated until the load reaches the value of 80% of the minimum ultimate transverse load and thereafter increased by 5% of the minimum ultimate transverse load until failure. Each time the load is applied, it shall be held for 2 minutes. The ultimate transverse load shall not be less than the design ultimate transverse load.

**5.2 Measurement of Cover**

The cover shall be measured at 3 points, one within 1.8m from the butt end of the pole, second within 0.6m from the top and the third at the intermediate point. The mean value of the measured cover should not differ by more than +/-1mm from the specified value, and the individual value should not differ by more than +/-3mm from the specified value.

**5.3 The number of poles selected for testing and their conformity criteria shall be as follows:**

---

<i>Lot Size</i>	<i>Sample Size</i>	<i>Permissible No. of Defective Samples</i>	<i>No. of Poles for Transverse Strength Test</i>
Up to 100	10	1	2
101 to 200	15	1	3
201 to 300	20	2	4
301 to 500	30	3	5

- 5.4 All the poles selected in 5.3 shall be tested for overall length, cross-section and uprightness. The tolerance shall be +/-15mm on overall length, +/-3mm on cross-sectional dimensions, and 0.5% on uprightness.
- 5.5 The number of poles which do not satisfy the requirements of overall strength, cross-section and uprightness shall not exceed the number given in 5.3. If the number of such poles exceeds the corresponding number, all poles in the lot shall be tested for requirements, and those not satisfying the requirements shall be rejected.
- 5.6 All the poles tested for transverse strength test shall satisfy the requirements of the test. If one or more poles fail, twice the number of poles originally tested shall be selected from those already selected and subjected to test. If there is no failure among these poles, the lot shall be considered to have satisfied the requirements of the test.

## 6. Marking

The poles shall be cleanly and indelibly marked with the following:

- Month and year of manufacture, at approximately 3m from the butt end;
- Specified working load in kg, at approximately 3m from the butt end; and
- The design lifting point.

## 8. Bid Documentation

- 8.1 The Bidder shall furnish following documents together with Bid;
- Two (2) clear copies of the standards, governing fabrication and testing of pre-stressed concrete poles and two (2) clear copies of other standards indicated in the specifications.
  - Two (2) clear copies of detailed design and drawings of each type of pole.
  - Two (2) clear certified copies of all tests performed on similar poles of same sizes and similar working loads.
  - A clause-by-clause commentary on specification, specifying compliance and deviations, if any.

8.2 The Bidder shall provide the following details:

- a) Pole dimensions in cross-section and pole taper;
- b) Location and size of pre-stressing strands;
- c) Hole locations;
- d) Design ground line;
- e) Marking of the lifting point;
- g) Minimum ultimate transverse load;
- h) Transverse load at first crack
- i) Concrete design mix and cement specification
- j) Specifications of the pre-stressing strands, their tensile strength and sizes

**Table: 2**

**Pole Attributes**

Overall Length	11m	9m
Point of Application of Load from Pole Top	0.6m	0.125m
Minimum Depth of Planting ( shall be based on site condition)	1.8m	1.5m

## TECHNICAL DATA SHEETS

(To be completed by Bidder)

### Item: Pre-stressed Concrete Pole

<i>Description</i>		<i>Unit</i>
1.	Manufacturer	
2.	Reference Standard	
3.	Overall Length	meters
4.	Dimensions:	<u>11m</u> <u>9m</u>
	- Top Width	mm
	- Bottom Width	mm
	- Pole thickness	mm
5.	Weight of the pole	kg
6.	Guaranteed minimum Transverse Failure Load	kgf

Signed \_\_\_\_\_

On behalf of \_\_\_\_\_

Address \_\_\_\_\_

Date \_\_\_\_\_

## SPECIFICATION: SP 1.2

### TUBULAR STEEL POLE

#### 1. Scope

- 1.1 This Specification covers the design, fabrication, testing and supply of swaged type galvanized tubular steel poles to be used to support overhead electric lines and equipment.

#### 2. Description

- 2.1 The poles shall be fabricated of seamless tubes of suitable lengths swaged together as specified in **Table 1** made out of welded tubes. The diameters of various sections of the fabricated pole shall be as specified therein. A bid not conforming to the requirements of **Table 1** shall be rejected as being non responsive.
- 2.2 The separate galvanized steel pole cap shall be provided with top section of the pole. The bottom section of the pole shall be provided with a base plate. The base plate shall be square of size 300x300 mm and 10 mm thick shall be welded at the bottom of the pole. The base plate shall have a hole of dia. approx. 50 mm in the center, for draining out of water.
- 2.3 The supply quantity of tubular steel poles are given in the Price Schedule

#### 3. Material

- 3.1 The poles shall be fabricated from steel having tensile strength not less than 540 N/mm<sup>2</sup>. The pole shall be composed of three sections in diminishing diameters and minimum diameter and thickness and lengths of poles shall be as shown in **Table 1**.
- 3.2 The steel tubes shall confirm to the requirements of BS 6323 Parts 1 to 8 Steel Tubes, or IS:2713, or latest revision thereof or other recognized international standards that ensures at least a substantially equal quality to the standard mentioned above.

#### 4. Manufacture

- 4.1 All tubes forming the part of the pole shall be made from hot finished seamless or continuously welded steel in accordance with BS 6323 or IS 2713, or equivalent international standards.
- |    |                                |  |
|----|--------------------------------|--|
| a) | Tolerance on outside diameter: | +/- 1%   |
| b) | Tolerance on length:           | +/- 40mm on any section<br>+/-25mm on overall length |
| b) | Tolerance on weight:           | +/- 7.5% on each pole.<br>+/- 7.5% on a bulk load    |

- c) Tolerance on thickness:  $\pm 10\%$  .
- e) The out-of-straightness of the finished pole shall not exceed 1/600 of its length.

4.2 All welding of the poles shall be carried out at the manufacturers' plant.

4.3 Each section of the pole shall have only one longitudinal weld. No circumferential joints/welds of the tubes are permitted. All welds shall be capable of withstanding, without failure or cracking the stresses in a pole when subjected to its ultimate design loads.

4.4 The pole shall have hole configurations and sizes as shown in the drawings attached to this specification. The hole sizes and the locations of the hole must however be confirmed with the Project prior to manufacture.

## 5. Corrosion Protection

5.1 Galvanizing shall be applied by the hot dip process, and shall be done in single bath (single dip) to result in a uniform thickness both internally and externally. Galvanizing of the poles shall be done after completion of fabrication process. Drilling, punching, cutting, bending and removal of burrs shall be completed before galvanizing. The preparation for galvanizing and the galvanizing process shall not adversely affect the mechanical properties of the material being coated. All galvanizing shall be in accordance with EN ISO 1461:1999 or IS:4736 or an equivalent international standards, and shall result in uniform thickness galvanization and be free from defects. The pole cap and the base plate shall also be galvanized.

5.2 The average thickness of the zinc coating shall not be less than  $500 \text{ g/m}^2$  (equivalent to 70 microns) of zinc for all surfaces of steel including the base plate and the pole cover.

## 6. Marking of Pole

6.1 The pole shall have an identification marked with indelible paint on the pole at a position approximately 3.5 m. from the butt end, which is clearly and indelibly marked with:

- a) Date of manufacture and identification mark of manufacture.
- b) Length of pole in meters and its design working loads as defined in this specification.

6.2 The pole shall be marked with a permanent horizontal line at a point 1/6th of the pole height from the butt end of the assembled pole.

## 7. Earthing Lug, Base Plate and Pole Cap

Each pole shall be provided with earthing lug at 300 mm above the ground level. Separate pole cap shall be provided for each pole. The plate for pole cap shall be of 3 mm. minimum thickness.

**8. Tests**

8.1 The following test(s) shall be performed on finished poles all testing shall be fully documented and certified test reports shall be provided to the Project.

- Test for dimensional and structural properties, and for the physical requirements of the finished poles
- Test for galvanization
- Tensile test and chemical analysis test
- Deflection test
- Permanent set test, and
- Drop test.

8.2 Poles selected for tests shall be a representative sample from each lot. The number of poles selected for conducting deflection, permanent set and drop tests shall be as follows:.

<u>Lot Size</u>	<u>No. of poles</u>
Up to 500	5
501 to 1000	8
1001 to 2000	13
2001 to 3000	18
3001 and above	20

8.3 The number of poles selected for conducting tensile test and chemical analysis tests shall be as follows:

<u>Lot Size</u>	<u>No. of poles</u>
Up to 500	1
501 to 1000	2
1001 to 2000	3
2001 to 3000	4
3001 and above	5

8.4 The above test shall be performed as per IS 2713 or other recognized international standards. The following particulars shall be recorded:

- a) Manufacturer's name and plant location;
- b) Batch No. of steel plate or tubing;
- c) Test date;
- d) Pole type;
- e) Dimensions of pole;
- f) Increments of load and the deflections at each increment of load;
- g) Permanent deflection;
- h) Load of failure;

- 8.5 For deflection test, each pole shall be rigidly supported for a distance from the butt end equal to the length the depth to which it to be planted in the ground. It shall then be loaded as cantilever and the appropriate deflection load applied at right angle of the axis of pole 300 mm from the top of the poles for poles up to 9m length and 600 mm for poles over 9m length. The temporary deflection at the point of application of the applied load shall not exceed 157.5 mm
- 8.6 The permanent set test shall be carried out immediately after the deflection test, on the same test sample. After application of the proper load, the permanent set measured from the zero position at the point of application of load after the release of the applied load shall not exceed 13 mm.
- 8.7 To perform the drop test, the pole shall be dropped vertically with the bud end downward, three times in succession from a height of 2 m onto a hardwood block 150 mm thick laid on a concrete foundation. The pole shall not show any signs of telescoping or loosening of joints.
- 8.8 Should any of the poles first selected fail to pass any of the tests specified above, two further poles shall be selected for testing from the same batch i.e. same pole length manufactured on the same day from the same steel plate or tubing in respect of each failure. Should one or both these additional poles fail, the test material represented by the test samples shall be deemed as not complying with this specification.

## **9. Quality Assurance Program**

- 9.1 Along with the Bid the Bidder shall furnish quality assurance program of the manufacturer which includes the Quality System and the Quality Plans, which shall include, among others, information to meet the following requirement, failing which the Bid shall be liable for rejection.
  - i. The structure of the organization;
  - ii. The duties and responsibilities assigned to staff ensuring quality of works;
  - iii. The system for purchasing, taking delivery and verification of materials;
  - iv. The system for ensuring quality of workmanship;
  - v. The quality assurance arrangement shall conform to relevant requirements of ISO9000;
  - vi. Statement giving list of important raw materials, names of manufacturer for the raw materials, list of standards according to which the raw materials are tested, list of test normally carried out on raw materials;
  - vii. List of manufacturing facilities available;
  - viii. List of areas in manufacturing process, where stage inspections are normally carried out for quality control and details of such tests and inspections;
  - ix. List of testing equipment available with the manufacturer for final testing of equipment specified and the test plant limitation, if any, vis-à-vis the type, special, acceptance and routine tests specified in the relevant standards.
- 9.2 The manufacturer shall perform, among others, the following inspections/test on each consignment of raw steel, prior to fabrication. A certificate shall be provided to the Employer showing the test results:

- i. Visual, dimensional and mechanical tests, to identify the steel meets the required strength/grade ensure compliance with the relevant Standards, and to ensure the absence of rust and surface imperfections. If the steel does meet the strength or grade required, the batch shall be rejected.
- ii. Dimensional tests to ensure that the material is within the production tolerances of IS 2713 or BS 4360 and BS 6323 or equivalent Standards. One sample shall be taken from each batch for which a certificate is provided. If the first sample fails the test, a second sample shall be taken. If the second sample fails the test, the batch shall be rejected.

## **10. Packing**

Poles shall be stacked together and banded securely to ensure that each individual bundle does not break or the shifting of individual poles does not take place during transportation and handling. Any loose items shall be suitably banded together or packed to avoid loss during transportation and storage.

## **11. Bid Documentation**

- 11.1 The Bidder shall provide with the Bid two (2) clear copies of the governing standards for selection of tubing, fabrication and testing of Tubular Steel Poles and two (2) clear copies of all other relevant standards referenced therein.
- 11.2 The Bidder shall provide a complete design, description and certified dimensional drawings of each type of pole.
- 11.3 A clause-by-clause commentary on specification, specifying compliance and deviations, if any.
- 11.4 All data, drawings, catalogues and other technical documents shall be bound separately from the Bid documents.

**TABLE 1**

**Pole Attributes**

Overall Length	11m	9 m
Pole Designation:	SP57	SP30
Section Length:		
Top (h1)	2.7 m	2.0 m
Middle (h2)	2.7 m	2.0 m
Bottom (h3)	5.6 m	5.0 m
Outside Diameter:		
Top (h1)	139.7 mm	88.9 mm
Middle (h2)	165.1 mm	114.3 mm
Bottom (h3)	193.7 mm	139.7 mm
Thickness:		
Top (h1)	4.5 mm	3.25 mm
Middle (h2)	4.85 mm	4.5 mm
Bottom (h3)	5.9 mm	5.4 mm
Crippling load	722 kgf	400 kgf
Approximate weight	256 kg	133 kg
Application of Load from top of pole	0.6 m	0.3 m
Depth of Planting	1.8 m	1.5 m

TECHNICAL DATA SHEETS  
(To be completed by Bidder)**Item: Galvanized Tubular Steel Poles**

1. Manufacturer
2. Governing Standards for tubing manufacturing and testing
3. Are the poles fully galvanized? Yes/No
4. Governing Standard for Galvanization
5. Copies of Standards Attached? Yes/No
6. No. of sections No.
7. Sections starting from the top:

<i>Description</i>	<i>Unit</i>	<i>11m</i>	<i>9m</i>
--------------------	-------------	------------	-----------

Top Section:

-Length	m
-Thickness	mm
-Dia. (outer)	mm

Top Section:

-Length	m
-Thickness	mm
-Dia. (outer)	mm

Top Section:

-Length	m
-Thickness	mm
-Dia. (outer)	mm

8. Weight of pole kg
9. Crippling load kgf

Signed \_\_\_\_\_

On behalf of \_\_\_\_\_

Address \_\_\_\_\_

Date \_\_\_\_\_

**SPECIFICATION: SP 2.1****PORCELAIN INSULATORS****1. Scope**

This Specification covers the fabrication and supply of pin insulators, disc insulators and stay insulators, as herein specified for use on overhead power line construction.

**2. General**

- 2.1 Insulators shall be fabricated and tested in accordance with the Standards referenced for each type of insulator or equivalent standards.
- 2.2 Porcelain shall be sound, free from defects, thoroughly vitrified and smoothly glazed. The glaze shall be brown in color. The glaze shall cover all exposed parts of the insulators.
- 2.3 The design of insulators shall be such that stresses due to expansion and contraction in any part of the insulator shall not lead to deterioration. The porcelain shall not engage directly with hard metal.
- 2.4 The cement used in construction of insulators shall not give rise to chemical reaction with metal fittings and its thickness shall be as uniform as possible.
- 2.5 The insulators should be manufactured in automatic temperature-controlled kilns to obtain uniform baking and better electrical and mechanical properties.
- 2.6 The manufacturer of the Insulators must have been accredited with ISO 9001 (including design in the scope of registration) quality certification.

**3. Pin Insulator**

- 3.1 The pin insulator shall be manufactured and tested in accordance with IS: 731-1971 and IS:3188 or the latest version thereof or any other national or international standards that ensures at least equal or better quality to the standard mentioned above, will also be acceptable. The lead thread shall be compatible with the insulator pin specified in these documents.

The pin insulator shall have following ratings and features:

Highest system voltage	12 kV
Rated voltage	11 kV
Creepage distance (min)	265 mm
Wet power frequency withstand voltage	35 kV
Impulse withstand voltage	75 kV
Puncture power frequency voltage (min)	105 kV

Visible discharge voltage (Effective)	9 kV
Cantilever strength	5 KN
G I pin head	Small
	IS Ref.165P Thimble type
	IS 2486 Part-II

#### **4. Disc Insulator**

- 4.1 The disc insulator shall be manufactured and tested in accordance with IS: 731-1971 or latest version thereof or any other national or international standards that ensures at least equal or better quality to the standard mentioned above, will also be acceptable.

The disc insulator shall be ball and socket fitting type. The disc insulator shall have the following ratings and features:

- Highest system Voltage	12 kV
- Rated Voltage	11 kV
- Porcelain Diameter (min)	255 mm
- Spacing	145 mm
- Creepage Distance (min)	280 mm
- Power Frequency Puncture withstand Voltage	1.3 x Actual dry flashover voltage
- Wet Power Frequency Withstand Voltage	35 kV
- Impulse Withstand Voltage	75 kV
- Puncture Power Frequency Voltage (min)	105 kV
- Visible Discharge Voltage	9 kV
- Mechanical Strength	45 kN
- Ball and Socket Size	16 mm B
- Applicable Standard for Special Characteristics	IS: 3188-1980

#### **5. Stay Insulator**

The stay insulator shall be manufactured and tested in accordance with IS: 5300-1969 or latest version thereof or any other national or international standards that ensures at least equal or better quality to the standard mentioned above, will also be acceptable.

The stay insulator shall have the following ratings and features:

- Highest system Voltage	12 kV
- Rated Voltage	11 kV

-	Creepage Distance (min)	41 mm
-	Minimum failing load	> 40 kN
-	Power Frequency Withstand Voltage	
	Dry	18 kV
	Wet	8 kV
-	IS designation	A

## 6. Marking

6.1 Each insulator shall be legibly and indelibly marked to show the following:

- a) Name or trademark of manufacturer.
- b) Year of manufacture.
- c) Minimum failing load in Newton
- d) Name of Project “NEA-DSRLRP”

6.2 Markings on porcelain shall be printed and shall be applied before firing.

## 7. Tests

The insulators shall comply with the following tests as per IS: 731-1971.

### 7.1 Type Test

- a. Visual examination,,
- b. Verification of dimensions,
- c. Visible discharge test,
- d. Impulse voltage withstand test,
- e. Wet power frequency voltage withstand test
- f. Temperature cycle test,
- g. Mechanical failing load test
- h. 24-hour mechanical strength test for strain insulators
- i. Puncture test
- j. Porosity test and
- k. Galvanizing test

### 7.2 Routine Test :

The following pre-shipment factory inspection / tests shall be performed on the pin insulators in the presence of the two inspectors appointed by NEA before delivery.

- Visual examination
- Mechanical routine test
- Electrical routine test

## 8. BID DOCUMENTATION

- 8.1 The Bidder shall provide with the Bid two (2) clear copies of the governing standards for fabrication and testing of pin insulator and insulator pin and two (2) clear copies of all other relevant standards referenced therein.
- 8.2 The Bidder shall provide certified type test results of pin insulator and insulators pin as required by governing standards.
- 8.3 The Bidder shall provide standard catalogue and certified dimensional drawings of pin insulator and insulator pins.
- 8.4 A clause-by-clause commentary on specification, specifying compliance and deviations, if any.
- 8.5 All data, drawings, catalogues and other technical documents shall be bound separately from the Bid documents.

**TECHNICAL DATA SHEET**

(To be completed by Bidder)

**Item: Pin Insulator**

<i>Description</i>	<i>Unit</i>
1. Manufacturer	
2. Catalogue/ Dimensional drawings	Yes/No
3. Governing Standards	
4. Copies of Standards Attached:	Yes/No
5. Copies of type test attached?	Yes/No
6. Marking as per specifications	Yes/No
7. Ratings:	
Highest System Voltage	kV
Rated Voltage	kV
Creepage Distance (min)	mm
Wet Power Frequency Withstand Voltage	kV
Impulse Withstand Voltage	kV
Puncture Power Frequency Voltage (min)	kV
Visible Discharge Voltage (Effective)	kV
Cantilever Strength	kN
G.I. Pin Head	

Signed \_\_\_\_\_

On behalf of \_\_\_\_\_

Address \_\_\_\_\_

Date \_\_\_\_\_

**TECHNICAL DATA SHEET**

(To be completed by Bidder)

**Item: Disc Insulator**

	<i>Description</i>	<i>Unit</i>
1.	Manufacturer	
1.	Catalog/Dimensional drawings	Yes/No
3.	Governing Standards	
4.	Copies of Standards Attached:	Yes/No
5.	Copies of type test attached?	Yes/No
6.	Marking as per specifications	Yes/No
7.	Ratings:	
	Highest system Voltage	kV
	Rated Voltage	kV
	Porcelain Diameter (min)	mm
	Spacing	mm
	Creepage Distance (min)	mm
	Power Frequency Puncture Withstand Voltage	kV
	Wet Power Frequency Withstand Voltage	kV
	Impulse Withstand Voltage	kV
	Puncture Power Frequency Voltage (min)	kV
	Visible Discharge Voltage	kV
	Mechanical Strength	kN
	Ball and Socket Size	mm
	Applicable Standard	

Signed \_\_\_\_\_

On behalf of \_\_\_\_\_

Address \_\_\_\_\_

Date \_\_\_\_\_

**TECHNICAL DATA SHEET**

(To be completed by Bidder)

**Item: Stay Insulator**

<i>Description</i>	<i>Unit</i>
1. Manufacturer	
2. Catalog/Dimensional drawings	Yes/No
3. Governing Standards	
4. Copies of Standards Attached:	Yes/No
5. Copies of type test attached?	Yes/No
6. Marking as per specifications	Yes/No
7. Ratings:	
Highest system Voltage	kV
Rated Voltage	kV
Creepage Distance (min)	mm
Minimum failing load	kN
Power Frequency Withstand Voltage (1 min)	
Dry	kV
Wet	kV
IS Designation	

Signed \_\_\_\_\_

On behalf of \_\_\_\_\_

Address \_\_\_\_\_

Date \_\_\_\_\_

## SPECIFICATION: SP 2.2

### INSULATOR PINS

#### 1. Scope

This specification covers the fabrication and supply of bolt type cross arm insulator pins.

#### 2. Description

The insulator pin to be supplied shall conform to the nominated standards or to internationally accepted standards and to the shape and dimensions shown in the drawings contained in this specification. The insulator pin shall be furnished with a spring steel split lock washer and nut assembled on the insulator pin. The ratings and features of the insulator pins shall be as follows:

	<b>For 11 kV</b>
Head type	Small S165P
Total length	315 mm
Stalk length	165 mm
Shank length	150 mm
Minimum failing load	5 KN
Applicable standard	IS: 2486 (Part I & II) or equivalent national or international standard.

The insulator pins shall be compatible with the insulators specified above.

#### 3. Material

The insulator pins specified herein shall be fabricated from hot rolled steel. The pin shall be a single piece obtained preferably by the process of forging. It shall not be made by jointing, welding, shrink fitting or any other processes from more than one piece of material. It shall be of good finish free from flaws and other defects. The finish of the collar shall be such that a sharp angle between the collar and the shank is avoided.

#### 4. Galvanizing

All ferrous pins, nuts and washers except those made of stainless steel shall be hot dip galvanized. The threads of nuts shall be cut after galvanizing and shall be well oiled and greased. The galvanizing shall conform to IS 2629-1985 or equivalent national or international standard.

#### 5. Finish

All insulator pins shall be reasonably smooth on all surfaces and free of sharp projections.

#### 6. Tests

Insulator pins shall comply with the following tests as per IS: 2486.

**6.1 Type Tests**

- Visual examination test,
- Checking of threads on head,
- Galvanizing test,
- Mechanical test.

**6.2 Acceptance Tests**

- Checking of threads on head,
- Galvanizing test,
- Mechanical test.

**6.3 Routine Test**

- Visual examination.

**7. BID DOCUMENTATION**

- 7.1 The Bidder shall provide with the Bid two (2) clear copies of the governing standards for fabrication and testing of pin insulator and insulator pin and two (2) clear copies of all other relevant standards referenced therein.
- 7.2 The Bidder shall provide certified type test results of pin insulator and insulators pin as required by governing standards.
- 7.3 The Bidder shall provide standard catalogue and certified dimensional drawings of pin insulator and insulator pins.
- 7.4 A clause-by-clause commentary on specification, specifying compliance and deviations, if any.
- 7.5 All data, drawings, catalogues and other technical documents shall be bound separately from the Bid documents.

**TECHNICAL DATA SHEETS**

(To be completed by Bidder)

**Item: Insulator Pins**

	<i>Description</i>	<i>Unit</i>
1.	Manufacturer	
2.	Type of Steel Used	
3.	Dimensional drawings attached?	Yes/No
4.	Governing Standard	
5.	Copies of Standards Attached:	Yes/No
6.	Copies of type test attached?	Yes/No
7.	Ratings and Features:	
	Head Type	
	Total Length (mm)	
	Stalk Length (mm)	
	Shank Length (mm)	
	Minimum Failing Load (kN)	
	Applicable Standard	
	Catalogue Number	
	IS reference	

Signed \_\_\_\_\_  
On behalf of \_\_\_\_\_  
Address \_\_\_\_\_  
Date \_\_\_\_\_

## **SPECIFICATION: SP 2.3**

### **DISC INSULATOR FITTINGS**

#### **1. Scope**

This Specification covers the fabrication and supply of tension type disc insulator fittings, for use on overhead power line construction.

#### **2. Description**

The disc insulator fittings shall be supplied with ball and socket couplings and twisted straps. The insulator fittings shall conform to the shape and dimension shown in the drawings.

#### **3. Material**

- 3.1 Disc insulator fittings like Ball and socket, nuts, bolts shall be made of hot rolled steel and the twisted cross arm strap shall be made of MS sheet metal. Cotter bolts and U-bolts shall be of galvanized steel. Cotter pins shall be of stainless steel.
- 3.2 All forgings and castings shall be of good finish and free from flaws and other defects. The edges on the outside of fittings, such as the ball socket and holes, shall be rounded. The nominal dimensions of the ball and socket, ball eye and twisted cross arm straps, are given in Drawings. The ultimate strength of the fittings shall not be less than 41 KN.

#### **4. Galvanizing**

All ferrous fittings and the parts other than those of stainless steel, shall be hot dip galvanized as per IS: 2629-1985 or equal internationally recognized standards.

#### **5. Tests**

The disc insulator fittings shall comply with the following tests as per IS: 2486 or equivalent national or international standard.

##### **5.1 Type Test**

- Verification of Dimensions,
- Visual Examination Test
- Slip Strength Test,
- Mechanical Test,
- Electrical Resistance Test,
- Heating Cycle Test.

##### **5.2 Acceptance Tests**

- Verification of dimensions,
- Galvanizing,
- Mechanical Tests.

### **5.3 Routine Tests**

- Visual Examination Test
- Routine Mechanical Test

## **6. BID DOCUMENTATION**

- 6.1 The Bidder shall provide with the Bid two (2) clear copies of the governing standards for fabrication and testing of disc insulator and disc insulator fittings and two (2) clear copies of all other relevant standards referenced therein.
- 6.2 The Bidder shall provide certified type test results of disc insulator and disc insulator fittings as required by governing standards.
- 6.3 The Bidder shall provide standard catalogue and certified dimensional drawings of disc insulator and disc insulator fittings.
- 6.4 A clause-by-clause commentary on specification, specifying compliance and deviations, if any.
- 6.5 All data, drawings, catalogues and other technical documents shall be bound separately from the Bid documents.

**TECHNICAL DATA SHEET**

(To be completed by Bidder)

**Item: Disc Insulator Fittings**

	<i>Description</i>	<i>Unit</i>
1.	Manufacturer/Catalogue No.	
2.	Dimensional drawings attached?	Yes/No
3.	Governing Standard	
4.	Copies of Standards Attached:	Yes/No
5.	Copies of type test attached?	Yes/No
6.	Steel Classification	
7.	Ferrous parts are galvanized As per IS 2629 – 1985?	Yes/No
8.	Cotter Pins are Stainless Steel?	Yes/No
9.	Ultimate Strength of Fittings	kN

Signed \_\_\_\_\_  
On behalf of \_\_\_\_\_  
Address \_\_\_\_\_  
Date \_\_\_\_\_

**SPECIFICATION: SP 3.1**  
**LOAD BREAK SWITCH**

**1. Scope**

- 1.1 This specification covers the fabrication, testing and supply of epoxy insulated pole-mounted, 11 kV, vacuum interruption or air interruption type, 3-phase, gang-operated load break switches, complete with all accessories.
- 1.2 The quantity of the load break switches to be procured under this contract and the kV ratings have been specified in the Price Schedule.

**2. Description**

- 2.1 The manufacturer of Load Break Switches must have been accredited with ISO 9001 including design quality certification.
- 2.2 The switch assembly shall be fabricated and tested in accordance with IEC:60265-1, IEC: 60529 and IEC: 60060-1, or latest revision thereof or any recognized international standards that ensure at least a substantially equal quality to the standard mentioned above, will also be acceptable.
- 2.3 The switch shall be outdoor enclosed construction type, pole mounted, 3-pole, pre-assembled with load break switches for installation in 11 kV, 3-wire, uni-grounded circuits. The switch shall be designed so as to prevent the rain water from stagnation and shall be equipped with the air-tight plug for pressurizing in hermetically sealed test, if necessary.
- 2.4 The load break switch shall consist of vacuum bottle(s) encapsulated within solid dielectric epoxy modules or air insulated with spring-assisted operating mechanism. The mechanism shall consist of three vacuum bottles mechanically linked to a single, spring-assisted operating mechanism. The operating mechanism shall be actuated from outside the mechanism housing to be operated from ground. The switch enclosure shall be made of stainless steel plates.
- 2.5 The switch terminal bushings shall be fabricated of wet-process porcelain and shall contain clamp-type terminals accepting copper or aluminum conductors ranging from 25 sq. mm. to 150 sq. mm. An earthing terminal shall be provided on the exterior of the switch, complete with clamp-type terminal that will accept grounding conductors to 50 sq. mm.
- 2.6 The switch shall have ground level pole mounted manual operating mechanism that will operate the switch mechanism in lockable OPEN or CLOSED positions. The switch operating mechanism shall incorporate flexible or rigid control members from the operating handle to the switch mechanism. The switching mechanism shall be robust and easily replaceable.
- 2.7 The switch shall be provided with galvanized cross arms and bracing suitable for mounting in 11 meter long, single pre-stressed concrete pole or steel tubular pole. The switch assembly shall also incorporate a pole-mounting frame for the ground level operating

handle suitable for steel telescopic tubular poles ranging in diameter from 140 mm to 300 mm and for pre-stressed concrete poles ranging in width from 200 mm to 350 mm and depth from 140 mm to 180 mm. A drawing with the mounting arrangement shall be furnished with the bid.

2.8 The switch shall be supplied with all other accessories, not specifically mentioned above, for complete installation, including the following:

- Lifting provisions.
- Corrosion-resistant nameplates and line diagram.
- Switch operating mechanism(s) with padlock provision and single keylock provision.
- Ground provisions

2.9 The switch shall be rated as follows:

Rated Maximum Voltage	12 kV
Nominal Voltage	11 kV
Rated Frequency	50 Hz
Rated Normal Current	400 to 600 A
Momentary Current (RMS)	40 kA
Rated Short Circuit Making Current (Peak)	50 kA
Impulse withstand voltage	95 kV
Min. power frequency withstand voltage	
Dry	42 kV
Wet	30 kV

### 3. Tests

The switch shall be tested in accordance with the relevant provisions of the governing standard.

### 4. Bid Documentation

4.1 The Bidder shall furnish two (2) clear copies of governing standards for fabrication and testing of switch and two (2) clear copies of all other relevant standards.

4.2 The Bidder shall furnish two (2) clear certified copies of all tests performed on of switch offered type of the load break switch as required by the governing standard.

4.3 The Bidder shall furnish two (2) clear certified copies of catalogue and outline drawings for each type of switch showing dimensions, arrangements and name and location of all parts.

4.4 The Bidder shall furnish a clause-by-clause commentary on specification, specifying compliance and deviations, if any.

4.5 All data, drawings, catalogues and other technical documents shall be bound separately from the bids.

## TECHNICAL DATA SHEETS

(To be completed by Bidder)

Item	Load Break Switch	
	<i>Description</i>	<i>Unit</i>
1.	Manufacturer	
2.	Catalog Number(s)	
3.	Governing standards	
4.	Copies of Certified Test results attached?	Yes/No
5.	Description and drawings of Switch attached?	Yes/No
6.	Drawings with pole mounting arrangement attached?	Yes/No
7.	Is the load breaking vacuum interruption type?	Yes/No
8.	Is the medium of insulation epoxy resin (solid dielectric)?	Yes/No
9.	Switch Ratings:	
	Rated Voltage	kV
	Nominal Voltage	kV
	Frequency	Hz
	Rated Current	Amp
	Rated Short Circuit Making Current	Amp
	Impulse withstand voltage	kV
	Min. power frequency withstand voltage	
	Dry	kV
	Wet	kV
	Mechanical endurance	Operations
10.	Are all the accessories including necessary hardware for pole mounting offered?	Yes/No.

## SPECIFICATION: SP 3.2

### SURGE ARRESTERS

#### 1. SCOPE

This specification covers the manufacture, testing and supply of distribution type polymer-housed surge arresters commonly installed on overhead power lines.

#### 2. DESCRIPTIONS

- 2.1 The surge arresters shall be suitable for use on a three-phase, wye-connected, ungrounded (solid grounding), 11 kV, 50 Hz distribution circuits at an altitude up to 2000 meters, and ambient temperatures ranging from -5 deg. C to 45 deg. C.
- 2.2 The surge arrester housing shall be of polymer type, manufactured using industry recognized polymeric material having superior insulating properties necessary for outdoor installations. The housing shall display in an indelible manner: Arrester type, voltage rating, and year of manufacture.
- 2.3 The surge arresters shall be of gapless metal-oxide type.
- 2.4 The surge arresters shall have line terminals and ground lead terminals accommodating copper or aluminium conductor sizes from 13.3 mm sq. through 53.49 mm sq. Each arrester shall be provided with nut and wire clamp as the line terminal and ground terminal accessory hardware.
- 2.5 The surge arresters shall be furnished with necessary mounting bracket and accessories necessary for steel channel (100x50x50x6mm) cross-arm mounting.
- 2.6 The surge arresters must be manufactured by a company approved to quality standard ISO 9001. The ISO 9001 certification number, the name of the authorized approving authority with the contact address and telephone and fax numbers shall also be stated. The Bidder shall enclose a verified copy of the ISO 9001 certificate with the bid.
- 2.7 The surge arresters shall have the following characteristics:

a.	Voltage rating ( $U_r$ ), Vrms	9
b.	Nominal system voltage, kVrms	11
c.	Maximum system voltage, kVrms	12
d.	System frequency, Hz	50
e.	Nominal discharge current, kA	10
f.	Creepage distance (terminal to base), mm	390
g.	Minimum power-frequency withstand	
	Wet, kVrms	50
	Dry, kVrms	70
h.	Impulse withstand (1.2/50µsec), kVcrest	95
i.	Maximum discharge (residual) voltage at 10kA lightning impulse current, kVcrest	29
j.	Steep current residual voltage, kVcrest	32
k.	Pressure relief class	B
	High current	for 0.2s 20 kA
	Low current	for 0.5s 0.8 kA

The surge arresters shall be manufactured and tested in accordance with IEC 60099-4 (latest revision).

**8. QUANTITY**

3.1 The quantity of the arresters to be under this Bid shall be as given in price schedule.

**9. BID DOCUMENTATION**

4.1 The Bidder shall provide with the Bid two (2) clear copies of the governing test specification and a full description and list of electrical and protective characteristics of the surge arresters offered. The Bidder shall have to provide two (2) clear copies of certified type-set results of the surge arresters offered.

**TECHNICAL DATA SHEET**  
**(To be filled by the Bidder/Manufacturer)**

The Bidders/manufacturers are required to furnish the following information in the Data Sheet. Separate sheets can be used if additional space is required. The information furnished shall be supported by the catalogue and test reports. The information not supported by the catalogues, test reports etc. shall be deemed to have been "*Not provided*". The bidders/manufacturers are also required to underline the information asked for in the catalogue and /or test reports. Any deviation from NEA's requirements shall be clearly mentioned giving the reasons thereof.

S. No.	Description	NEA's requirement	Offered specifications
1.	Catalogue No. Model offered		
2	Applicable standard Certification:  Name of the authorized approving authority  Certification number  Date of certification  Address, telephone and fax numbers of the approving authority	IEC 600 99 ISO 9001 (including design)	
3	Copy of certified type test attached	To be provided	
4	Surge arrester type	Gapless metal oxide with polymer housing	
5	Ground lead disconnecter provided?	Yes	
6	Ratings:  a. System Voltage, kV  b. Max. system voltage, kVrms  c. Voltage rating (Ur), kVrms  d. System frequency, Hz  e. Nominal discharge current, kA  f. Creepage distance, mm  g. Min. power frequency	11   12   9  50  10 390	

	withstand Wet, kVrms Dry, kVrms	50 70	
	h. Impulse withstand (1.2/50µsec), kVcrest	95	
	i. Maximum discharge (residual) voltage at 10 kA lightning impulse current, kV crest	29	
	j. Steep current residual voltage, kV crest	32	
	k. Pressure relief class	B	
8	Governing standards and type test reports submitted	Yes	

Signed \_\_\_\_\_

On behalf of \_\_\_\_\_

Address \_\_\_\_\_

Date \_\_\_\_\_

### **SPECIFICATION: SP 3.3 DROP OUT FUSES**

#### **1 SCOPE**

This Specification covers the manufacture, testing and supply of drop out fuse commonly used on the primary side of 11 kV distribution transformers as protective device.

#### **2. DESCRIPTION**

- 2.1 The drop out fuse shall be suitable for use on three-phase, wye-connected, ungrounded, 50 Hz distribution circuits at an altitude up to 2000 meters.
- 2.2 The drop out fuse shall be tested in full compliance with ANSI C 37.41-1981, ANSI C 37.42 or IEC 60282-2.
- 2.3 The drop out fuse shall incorporate wet-process glazed porcelain insulators. The insulator shall display in an indelible manner: manufacture, type and voltage rating.
- 2.4 The fuse holder shall accommodate a non-expendable cap or an expendable cap determined by interrupting rating.
- 2.5 The drop out fuse shall be furnished with a galvanized steel-mounting bracket that may be adapted for steel channel (100x50x50x6mm) cross arm mounting.
- 2.6 The drop out fuse shall have clamp type terminals to accept copper or aluminium conductors ranging from 25 mm<sup>2</sup> to 150 mm<sup>2</sup>.
- 2.7 The drop out fuse must be manufactured by a company approved to quality standard ISO 9001 (including design in the scope of registration). The ISO 9001 certification number, the name of the authorized approving authority with the contact address and telephone and fax numbers shall also be stated. The Bidder shall enclose a verified copy of the ISO 9001 certificate with the bid.

#### **3. RATINGS**

- 3.1 The drop out fuse shall have the following electrical characteristics:

a) System voltage	kVrms	11
b) Design rating	kVrms	15
c) Minimum power frequency withstand:		
Dry kVrms		35
Wet kVrms		30
d) Impulse withstand, kVcrest		95
e) Interrupting capacity, kA		10

f) Creepage distance, mm (Leakage to ground)	220
g) Temperature Rise Limit (In air)	
i. Copper contacts silver faced	65 <sup>0</sup> C
ii. Terminals	50 <sup>0</sup> C
iii. Metal parts acting as spring	The temp. shall not reach such a value that elasticity of the metal is changed

3.2 The drop out fuse shall have fuse holder from 100 Ampere to 300 Ampere capacities.

#### **4. GENERAL REQUIREMENTS/CONSTRUCTIONAL DETAILS**

4.1 The typical constructional details of the drop out fuse are as follows:

- a. Copper current path;
- b. Copper arc shortening rod;
- c. Bird-proofed one-piece solid porcelain insulator;
- d. Tinned plated bronze terminals for use with copper or aluminium conductor;
- e. Two-place locking to prevent side movement of hood, contacts or hooks;
- f. One piece stainless steel channel;
- g. Stainless steel backup spring to maintain contact pressure;
- h. Silver to silver contacts;
- i. Galvanized steel hooks for load break tool;
- j. Cast bronze top tube casting and pull ring;
- k. High strength fibre glass fuse tube coated with ultra violet inhibitor;
- l. Hot stick hole in trunnion casting for hot stick work;
- m. Cast bronze lower tube casting;
- n. Stainless steel fuse link ejector and spring insures proper toggle action;
- o. Fuse holder toggle latch limits tension of fuse link;
- p. Cast bronze hinge for corrosion resistance;
- q. Large nut to fasten fuse link without breaking strands;

4.2 The design of drop out fuse shall be such that the fuse holder can be interchanged with those of other manufacturer.

#### **10. TESTS**

Tests shall be performed in accordance with the relevant latest IEC standards supplemented by the specific requirements indicated below. In the absence of IEC recommendations the

tests must be equivalent at least to the conditions, provisions and definitions of the above-mentioned standards.

### **5.1 Type Tests**

The Bidder shall submit, along with the Bid, detail type test reports performed on similar or higher rating of drop out fuse. The test shall have been conducted by recognised national or international testing lab in accordance with the latest version of IEC or ANSI C 37.41-1981, ANSI C 37.42 and it must include following tests :

- a. Dielectric tests (rated impulse withstand and rated one minute power frequency withstand test voltages)
- b. Temperature rise test
- c. Pull out test for embedded components of the fuse base (Mechanical test)
- d. Beam strength of porcelain base

### **5.2 Routine Test**

The drop out fuse shall be subjected to the routine tests at the manufacturer's premises as per applicable standards.

## **6. BID DOCUMENTATION**

- 6.1 The Bidder shall provide with the Bid literature/catalogue giving a full description of the drop out fuse and the fuse holders, including their operational details.
- 6.2 The Bidder shall provide a clear copy of certified type test results of the drop out fuse offered.
- 6.3 The Bidder shall provide with the Bid two (2) clear copies of the governing test specification and a full description and list of electrical and protective characteristics of the drop out fuse offered.

**DATA SHEET**

(To be filled in by the Bidder/ Manufacturer)

The Bidders/manufacturers are required to furnish the following information in the Data Sheet. Separate sheets can be used if additional space is required. The information furnished shall be supported by the catalogue and test reports. The information not supported by the catalogues, test reports etc. shall be deemed to have been *"Not Provided"*. The bidders/manufacturers are also required to underline the information asked for in the catalogue and /or test reports. Any deviation from NEA's requirements shall be clearly mentioned giving the reasons thereof.

S. No.	Description	NEA's requirement	Offered specifications
1.	Manufacturer: Catalogue No.: Model offered:		
2.	Applicable standard  Certification:  Name of the authorized approving authority Certification number Date of certification Address, telephone and fax numbers of the approving authority	ANSI C 37.41, C 37.42 or IEC 60282-2 ISO 9001 (Including design)	
3.	Copy of certified type test attached	To be provided	
4.	Steel mounting bracket provided	To be provided	
5.	Clamp type terminals for copper/ aluminium cable 25-150 mm <sup>2</sup> size	Yes	
6.	Ratings:		
	a. System Voltage, kVrms	11	
	b. Design rating, kVrms	15	
	c. System frequency, Hz	50	
	d. Min. power frequency withstand Wet, kVrms	30	
	Dry, kVrms	35	
	e. Impulse withstand, kVrms	95	
	f. Creepage distance (leakage to ground), mm	220	
	g. Interrupting capacity, kA	10	
7.	All the features mentioned in the specifications	Yes/No	

Signed \_\_\_\_\_

On behalf of \_\_\_\_\_

Address \_\_\_\_\_

Date \_\_\_\_\_

**SPECIFICATION: SP 3.4**  
**FUSE LINK**

**1. Scope**

This Specification covers the supply of button head fuse links commonly used in the protection of distribution transformers.

**2. Description**

- 2.1 The button-head fuse link shall be fabricated in full compliance with American National Standard specification ANSI C 37.42-1981, or latest revision thereof or any other national or international standards that ensures at least a substantially equal quality to the standard mentioned above, will also be acceptable.
- 2.2 The fuse link shall have fast characteristics and shall be suitable for protection of distribution transformers.
- 2.3 The fuse link shall be supplied in accordance with the type and ratings shown in the bid package.

**3. Bid Documentation**

- 3.1 The Bidder shall furnish two (2) clear copies of governing standards for fabrication and testing of fuse links
- 3.2 The Bidder shall furnish two (2) clear certified copies of catalogue of fuse links.
- 3.3 The Bidder shall furnish a clause-by-clause commentary on specification, specifying compliance and deviations, if any.
- 3.4 The Bidder shall also furnish with the Bid two (2) copies of the following data with respect to the fuse links furnished:
  - a) Time-Current (TC) characteristic curves at 30°C, including minimum melting time and total clearing time.
  - b) Preloading adjustment factors or curves.
  - c) Ambient temperature adjustment factors or curve
- 3.5 All data, drawings, catalogues and other technical documents shall be bound separately from the Bid documents

**DATA SHEET**  
(To be filled in by the Bidder/ Manufacturer)

Description	Queries
1. Manufacturer	
2. Catalog Numbers	
3. Governing Standard	
4. Copies of Standard attached?	
5. Time Curves attached	
Minimum melting time	Yes/No
Total clearing time	Yes/No
6. Preload adjustment data attached?	Yes/No
7. Ambient temperature adjustment data attached?	Yes/No

Signed \_\_\_\_\_  
On behalf of \_\_\_\_\_  
Address \_\_\_\_\_  
Date \_\_\_\_\_

### **SPECIFICATION: SP 3.5 MOULDED CASE CIRCUIT BREAKERS**

#### **1. Scope**

This Specification covers the manufacture, testing and supply of moulded-case circuit breakers (MCCB).

#### **2. Description**

- 2.1 The MCCB shall be fabricated and tested in accordance with IEC-60947-2 or latest revision, or any other national or international standards that ensures at least a substantially equal quality to the standard mentioned above, will also be acceptable.
- 2.2 The manufacturer of MCCBs must have been accredited with ISO 9001 including design quality certification.
- 2.3 The MCCB shall be suitable for connection to 400/230 volt, 3 -phase, 4 wire, uni-grounded circuits.
- 2.4 The MCCB shall be rated in accordance with the parameters shown in Table 1.
- 2.5 The MCCB shall be completely enclosed in a moulded case and shall be factory sealed. The MCCB shall have a quick make, quick break, over current switching mechanism that is mechanically trip-free for simultaneous tripping of all poles. Tripping due to overload or short circuit shall be clearly indicated by the position of the handle. The ON and OFF positions shall be clearly marked on the breaker case.
- 2.6 The MCCB shall have line load reversibility features.
- 2.7 Marking shall be in accordance with IEC-60947-2.
- 2.8 The MCCB shall be of inverse time and instantaneous trip type. The trip device shall be of thermal-magnetic, or static release type.
- 2.9 The MCCB shall be provided with terminal connection of the screw-type or bus-bar type as specified in Table 1. For MCCB with bus bar connection certain additional hardware shall be furnished with each MCCB as specified in Table 2.
- 2.10 The circuit breakers shall be suitable for mounting in outdoor distribution panels and each breaker shall be furnished complete with one (1) set of bolt fastenings, complete with nuts and lock washers of the correct diameter for the mounting hole and of a length equal to the depth of the MCCB body plus approximately two (2) centimetres.

#### **3. Tests**

Tests shall be carried out as per the requirements laid down in the relevant governing standards, which should at least include following tests:

Type Tests

- a) Temperature rise test
- b) Tripping limits and characteristics
- c) Dielectric properties
- d) Operational performance capability
- e) Overload performance
- f) Short-circuit breaking capacities
- g) Shot-time withstand current

Routine or Sample Test

- a) Mechanical operation test
- b) Calibration of releases
- c) Dielectric withstand

**4. Bid Documentation**

- 4.1 The Bidder shall furnish two (2) clear copies of the IEC Standards/governing standards for fabrication and testing of the MCCB and two (2) clear copies of all other relevant standards referenced therein.
- 4.2 The Bidder shall furnish two (2) clear certified copies of all type tests of MCCB as required by the governing standard.
- 4.3 The Bidder shall furnish two (2) clear certified copies of catalogue and outline drawings for each MCCB rating showing dimensions, arrangements and name and location of all parts.
- 4.4 The Bidder shall furnish two (2) copies of time - current characteristic trip curves for each breaker rating.
- 4.5 The Bidder shall furnish a clause-by-clause commentary on specification, specifying compliance and deviations, if any.
- 4.6 All data, drawings, catalogues and other technical documents shall be bound separately from the Bid documents.

**TABLE 1**  
RATING AND FEATURES

Rated Voltage	600 Volt
Rated Impulse Withstand Voltage	8 kV
Number of Poles	3
Ampere Ratings	As per Price Schedules
Ambient Temperature	-5 to 55 Degree C
Interrupting Capability	(IEC category P2)
Service Breaking Capacity:	
a) 50-100 Amps.	25 kA
b) 100-300 Amps.	36 kA

The MCCB rated 50 Amperes through 200 Amperes shall be furnished with thermal-magnetic or static trip.

The MCCB rated 250 - 500 Amperes shall be furnished with Thermal-adjustable magnetic or static trip.

The MCCB's are intended to be used in the Distribution Panel Boards of the distribution transformers and shall include busbar terminals as specified in table 2.

**TABLE 2**

**MCCB W/BUSBAR TERMINALS**

<b>BREAKER RATING</b>	<b>ADDITIONAL HARDWARE TO BE FURNISHED WITH EACH BREAKER</b>
100 – 500 AMPERES	4 x 95 sq. mm. compression type cable terminals and 16 x 50 sq. mm. compression type cable terminals mounted on MCCBs, 8 stacking bus spacers and additional 4 x 95 sq. mm. bolted type cable terminals mounted on the bus bar.

**Notes:**

Above hardware and accessories shall be assembled in the Distribution Panel and supplied accordingly.

All conductors will be stranded Aluminium.

All breaker terminals, compression terminals, stacking spacers, and bolting shall be compatible with Aluminium conductors to avoid bimetallic reaction.

**TECHNICAL DATA SHEET**

(To be filled in by the Bidder/ Manufacturer)

The Bidders/manufacturers are required to furnish the following information in the Data Sheet. Separate sheets can be used if additional space is required. The information furnished shall be supported by the catalogue and test reports. The information not supported by the catalogues, test reports etc. shall be deemed to have been "*Not Provided*". The bidders/manufacturers are also required to underline the information asked for in the catalogue and /or test reports. Any deviation from NEA's requirements shall be clearly mentioned giving the reasons thereof.

S. No.	Description	NEA's requirement	Offered specifications
1.	Manufacturer Catalogue No. Model offered		
2	Applicable standard Certification:	IEC 60947-2 ISO 9001 including Design	
3	Ratings and type: Rated Voltage, V Nominal current rating, A	600	
4	Service Breaking Capacity, A	25 kA up to 100 A 36 kA above 100 A	
5	Impulse withstand voltage, kV	8	
6	Interrupting Capability	(IEC category P2)	
7	Trip device	Thermal magnetic or static for breaker rated up to 200 A Thermal adjustable magnetic or static for rating greater than 200A	
8	Line load reversibility	Yes	
9	All Bid documents furnished	As per Clause 4 of Specs	
10	Ancillary fittings provided	As per Table 2	
11	Copies of standards attached?	Yes	
	Copies of certified type tests attached?	Yes	
	Copies of outline drawings attached?	Yes	
	Copies of time - current characteristic trip curves for each breaker rating attached?	Yes	

Signed \_\_\_\_\_

On behalf of \_\_\_\_\_

Address \_\_\_\_\_

Date \_\_\_\_\_

## **SPECIFICATION: SP 3.6**

### **DISTRIBUTION PANELBOARD**

#### **1. Scope**

This Specification covers the fabrication, testing and supply of Distribution Panel Boards.

#### **2. Description**

- 2.1 The panel board shall be pole-mounted and used in conjunction with pole-mounted distribution transformers to house moulded case circuit breaker (MCCB) feeding 400/230 Volt circuits.
- 2.2 The manufacturer of panel boards must have been accredited with ISO 9001 quality certification.
- 2.3 The panel board shall be rectangular in shape with an entrance door in the front of the panel board. The panel board shall be equipped with interior standoffs suitable for mounting MCCB and for supporting cables. The panel board will be fixed to the pole by exterior mounting brackets attached to the back of the panel board. Details of these components shall be as specified in the following text.
- 2.4 The panel board shall be fabricated to prevent ingress of moisture due to rainfall and dripping. The panel board shall be provided with means for natural ventilation.

#### **Material**

- 2.5 The panel board case and door shall be fabricated out of steel sheet of minimum 2 mm. in thickness and pole mounting brackets shall be fabricated out of mild steel flat of 6 mm. in thickness.
- 2.6 The interior standoffs shall be fabricated of steel sheet of sufficient thickness to support installed circuit breaker and cables without lateral movements.

#### **Construction**

- 2.7 The panel board case and all interior and exterior attachment shall be spot-welded. All welding shall be of the highest quality. The panel boards shall be formed and welded square and all attachments to the interior and exterior surfaces shall be welded square and perpendicular to the panel attached.
- 2.8 The panel board shall be so constructed as to be water tight from blowing of free-falling rain. There shall be no apertures in the panel board case other than those provided for the entrance door, cable fittings, or ventilation. The top extension and bottom shall be so formed to provide a drip edge and prevent water from flowing on the respective under-surfaces.

- 2.9 All individual pieces of metal shall be edge finished prior to assembly to provide surfaces and edges which are free from sharp points and edges. After welding in place, all welds shall be finished to smooth condition.

***Panel board Front***

- 2.10 The front panel shall be fabricated as a separate piece containing the panel board door and doorframe. The front shall be attached to the panel board housing by suitable bolting arrangements to provide a watertight and dust tight seal at the perimeter.
- 2.11 The door shall be equipped with a gasketed removable door, door-handle lock, and suitable hinges.
- 2.12 The door and panel frame shall be so fabricated to provide an integrated structure which is warp-resistant and which will maintain dust-tight and watertight seal.
- 2.13 Gasketing material shall be heat-resistant and shall retain its resilience over time to precluded degradation of dust-tight and watertight properties.
- 2.14 The insertable (and removable) door handle shall provide a door a locking function. The handle shall be insulated.
- 2.15 The door hinge may be continuous type or separate hinge units. However, the type of hinge furnished must accommodate, and not degrade, the dust-tight and watertight characteristics and must provide adequate door alignment and support over time.

***MCCB Standoffs***

- 2.16 The standoffs shall be shaped and dimensioned to accommodate the MCCBs as required by Bid Packages.
- 2.17 The standoffs shall be precisely located.

***Cable Standoffs***

- 2.18 The cable standoffs shall be properly shaped and dimensioned.
- 2.19 The standoff shall have the metal edges contoured and smoothed to prevent abrasion of applied cable serving.
- 2.20 The standoff shall be located within the panel board to make allowance for cable bending radii and the location of other components.

***Bus bars***

- 2.21 The neutral and phase bus bars shall consist of copper bus bar insulated from the panel board by 600 V porcelain insulators. The copper bus bar shall be of proper size (ampere capacity) and properly dimensioned.
- 2.22 The bus bars shall be located within the panel board to provide adequate clearance for the installation and correct functioning of all items.

- 2.23 If it is required to drill or penetrate the panel board back to install 600 V insulators, the outside of the panel board shall be permanently sealed over the attachment to retain water-tightness.

Cable Entrance Fittings and Knockouts

- 2.24 Knockouts for cable entrance fittings (bushings) shall be provided in the bottom of the panel board.
- 2.25 All necessary cable entrance fittings shall be supplied for proper connection of all circuits to fulfil the requirement of the Bid Package. The fittings shall be designed to be suitable for exposed cables entering the panel board from below and shall secure the cable with inserts to prevent lateral and longitudinal movement of the cables.
- 2.26 The fittings shall be threaded multi-piece construction which when installed securely locks the fittings to the panel board. The fittings may be of metal or polymer material. Metal fittings shall be galvanized or plated as appropriate. The fitting inserts may be single or multi pieces and shall be of material sufficiently elastic and resilient to securely grip the PVC cable sheath without damage. The fitting components shall enable capturing of the inserts to preclude insert creep and fallout due to clamping pressure.

***Ventilation***

- 2.27 The panel board shall be provided with apertures for natural draft ventilation in the panel board bottom and in the top overhang.
- 2.28 The ventilation apertures shall be covered with bronze screen materials of a mesh sufficiently to preclude passage of small insects. The edges of the bronze screening shall be surely fastened to the panel board by means of soldering or epoxy adhesive. The mesh shall be protected during panel board fittings to preclude clogging of mesh openings by finished materials.

Pole Mounting Bracket

- 2.29 The panel board shall be provided with two (2) pole mounting brackets. The size of poles will be confirmed by the Project before manufacturing.

***Grounding Stud***

- 2.30 The panel board shall be provided with a brass grounding stud located in an approved location.
- 2.31 The grounding stud shall be fitted to the panel board to insure low resistivity and water tightness of the installation.
- 2.32 The grounding stud shall be complete with pressure washer, lock washer, and nuts.

***Finish***

- 2.33 After fabrication, the panel board shall be thoroughly cleaned of all dirt, grease, mill scale, and weld slag on all interior and exterior surfaces and all surfaces of all component. After thorough cleaning of panel board one (1) coat of red oxide metal priming paint and two (2) finish coats of paint color shall be thoroughly applied. The paint color shall be of light grey. The finish coats shall be of oil based or epoxy paint. Alternatively, powder coating of panel board may also be acceptable.
- 2.34 The bronzed screen ventilation holes, working surfaces of door hinge and door lock, and outside face of grounding stud shall be free from all finishing materials.

**3. Bid Documentation**

- 3.1 The Bidder shall furnish two (2) copies of certified fabrication drawings showing all views, section, and dimensions of individual components and assembled panel board.
- 3.2 The Bidder shall furnish complete description of all materials to be used, including cable entrance fittings and finishing materials.
- 3.3 The Bidder shall furnish a clause-by-clause commentary on specification, specifying compliance and deviations, if any.
- 3.4 All data, drawings, catalogues and other technical documents shall be bound separately from the Bid documents.

## TECHNICAL DATA SHEET

(To be completed by Bidder)

Item Distribution Panel board

**Description**

**Unit**

- |    |  |        |
|----|--|--------|
| 1. | Manufacturer                                     |        |
| 2. | Copies of fabrication drawings attaches?         | Yes/No |
| 3. | Description of all materials attached?           | Yes/No |
| 4. | Description of cable entrance fittings attached? | Yes/No |

Signed \_\_\_\_\_

On behalf of \_\_\_\_\_

Address \_\_\_\_\_

Date \_\_\_\_\_

## **Drawings**

*The bidder is required to furnish the certified fabrication drawings showing all views, section, and dimensions of individual components and assembled panel board and shall take approval of drawings from the project prior to manufacture.*

## **SPECIFICATION: SP 4.1**

### **STAY SET**

#### **1. Scope**

This Specification covers the fabrication and supply of adjustable threaded, galvanized steel stay sets for use in overhead line construction.

#### **2. Material**

- 2.1 The stay set shall consist of mild steel, galvanized stay rod, stay tightener (turn buckle) or adjustable head, eyebolt for pre-stressed concrete pole or two-way clamp and twisted double-eye for steel tubular pole, thimbles complete with stay plate as shown in the conceptual drawings.
- 2.2 The manufacturer of the Stay Set must have been accredited with ISO 9001 or ISO 9002 quality certification.
- 2.3 The stay rod and stay tightener shall be made of mild steel of minimum ultimate tensile strength of 4200-kg/sq. cm.
- 2.4 The stay plate shall be square type mild steel plate.
- 2.5 The thimbles shall be made of 1.219mm (18 SWG) GI sheet.

#### **3. Description**

- 3.1 Conceptual drawings of stay set and its associate hardware are given in Dwg. CSG 17 and technical features and dimensions in Table 1.
- 3.2 The stay rod is either thimble-eye type or twin-eye type. The stay rod and suitable nut shall be fabricated to the shape and dimensions shown in CSG 17. The thimble-eye or twin-eye of the stay rod shall be made by drop-forged processing. The thread form at the threaded end of the rod, and that of the accompanying nut, shall be optional with the supplier. However, it shall be the responsibility of the Supplier to supply the stay rod with a thread form that shall sustain the rated loads specified in Table 1 without creep or stripping over the full life of the rod material at specified diameter.
- 3.3 The stay tightener shall be fabricated in accordance with the conceptual drawing shown in CSG 17.
- 3.4 The eyebolt shall be oval-eye type. The eyebolt shall be made by drop-forged processing. The eyebolt shall be supplied with suitable nut and washer.
- 3.5 The two-way clamp required for mounting stay set (stay tightener) in steel tubular pole shall be made of hot-rolled steel flat. The clamp shall be two half type and shall be provided with two numbers of nuts and bolts, diameter not less than 19 mm. The both

ways of the clamp shall be suitable for accommodating two numbers of twisted double-eye fittings described in Clause 3.6 below. The two-way clamp shall be following types:

- a) Type A: Suitable for pole diameter ranging from 180-230 mm.
- b) Type B: Suitable for pole diameter ranging from 140-180 mm.

- 3.6 The twisted double eye shall be made by drop-forged processing. The twisted double-eye shall be twisted in  $90^0$ . The diameter of the steel shall not be less than 16 mm, and eye of the twisted-eye shall be suitable for accommodating stay tightener.
- 3.7 The Stay plate shall be square and the plate shall have a matching hole at the center to fit the end of the stay rod.
- 3.8 The thimble shall be suitable for terminating steel stay wire with a preformed grip.
- 3.9 After galvanizing, the nut and rod threading shall be such that the nut may be run the full length of the thread without the use of tools.

#### 4. **Galvanizing**

- 4.1 All ferrous parts of the stay set shall be galvanized after fabrication in accordance with IS: 2629-1985 or the latest version thereof or any other national or international standards that ensures at least equal or better quality to the standard mentioned above, will also be acceptable.

#### 5. **Tests**

- 5.1 Apart from the tests indicated in the relevant referenced standards of steel, the stay set shall undergo following type tests:
  - Visual Inspection.
  - Verification of Dimensions.
  - Tensile test: The stay set assemblies shall withstand a minimum tensile loads specified in Table 1.
  - Bend test: The stay rod shall be bend-tested over a mandrel of 19 mm through an angle of 90 degrees at any point in the un-threaded section of the rod without fracture of the steel. Temperature of the test shall be 22.5 deg Celsius.
- 5.2 Routine tests shall be performed on each batch of the stay sets as per the relevant governing standards.

#### 6. **Quality Assurance Program**

Along with the Bid the Bidder shall furnish quality assurance program of the manufacturer which includes the Quality System and the Quality Plans, which shall include, among others, information to meet the following requirement, failing which the Bid shall be liable for rejection.

- i. The structure of the organization;
- ii. The duties and responsibilities assigned to staff ensuring quality of works;
- iii. The system for purchasing, taking delivery and verification of materials;
- iv. The system for ensuring quality of workmanship;
- v. The quality assurance arrangement shall conform to relevant requirements of ISO9000;
- vi. Statement giving list of important raw materials, names of manufacturer for the raw materials, list of standards according to which the raw materials are tested, list of test normally carried out on raw materials;
- vii. List of manufacturing facilities available;
- viii. List of areas in manufacturing process, where stage inspections are normally carried out for quality control and details of such tests and inspections;
- ix. List of testing equipment available with the manufacturer for final testing of equipment specified and the test plant limitation, if any, vis-à-vis the type, special, acceptance and routine tests specified in the relevant standards.

## **7. Bid Documentation**

- 7.1 The Bidder shall provide a complete description, catalogue and two (2) clear copies of certified dimensional drawings of all the components of the stay set.
- 7.2 A clause-by-clause commentary on specification, specifying compliance and deviations, if any.
- 7.3 All data, drawings, catalogues and other technical documents shall be bound separately from the Bid documents.

**TABLE 1**  
RATINGS AND FEATURES

	<b>HT Stay</b>	<b>LT Stay</b>
Length of stay rod, m.	2.44	1.8
Diameter of stay rod, mm.	19	16
Ultimate tensile strength of stay rod and tightner (min.), kg/sq. mm.	4200	4200
Minimum breaking load, kg.	10,454	7,272
Length of threaded portion, mm.	300	300
Thimble shape	Suitable for preformed for 7/8 SWG stay wire	Suitable for preformed for 7/12 SWG stay wire
Thimble section Min.), SWG	18	18
Stay plate section, mm.	600x600x6	300x300x6
Eyebolt length, mm./1	300	300
Galvanization	<b>IS: 2629-1985</b>	

Note:

- 1: For the steel tubular pole, two-way pole clamp and twisted double-eye shall be provided instead of eye-bolt.

## TECHNICAL DATA SHEETS

(To be completed by Bidder)

**Item:** **Stay Set**

<i>Description</i>	<i>Unit</i>	<i>Stay Set (19 mm.)</i>	<i>Stay Set (16 mm.)</i>
1. Manufacturer			
2. Catalog Numbers			
3. Steel Classification			
4. Governing Standard for galvanization			
5. Load rating, kg.			
6. Type tests-tensile load data attached?		Yes/No	Yes/No
7. Type test-bend test data attached ?		Yes/No	Yes/No
8. Dimensional drawing attached?		Yes/No	Yes/No

Signed \_\_\_\_\_  
On behalf of \_\_\_\_\_  
Address \_\_\_\_\_  
Date \_\_\_\_\_

**SPECIFICATION: SP 4.2**

**STRANDED STAY WIRE**

**1. Scope**

This Specification covers the fabrication and supply of galvanized stranded steel wire for use in overhead power line as stay wire ropes for line supports.

**2. Description**

- 2.1 The steel strand shall be fabricated in accordance with B.S. 183 1972/(1983) or any revision thereof or other equivalent national or international standard provided that the resulting steel stock is of equal quality and strength. The minimum tensile strength of the steel shall be 4200 kg/cm<sup>2</sup>. The wires shall be 45-ton quality.
- 2.2 The steel wire strand shall have a left-hand lay. The steel wires shall have no joint throughout the whole length. Strands shall be uniform and shall have no defects such as cracks, dust encapsulation or crevices. Further details are given in Table 1 herein.
- 2.3 The manufacturer of the Stranded Stay Wire must have been accredited with ISO 9001 or ISO 9002 quality certification.

**3. Galvanizing**

- 3.1 The stranded stay wire shall be galvanized after fabrication in accordance with IS: 2629-1985 or any revision thereof or any other national or international standards that ensure at least equal or better quality to the standard mentioned above will also be acceptable.

**4. Tests**

- 4.1 The stranded stay wire shall undergo type and routine tests in accordance with the governing standard.

**5. Packaging**

- 5.1 The stranded stay wire shall be furnished in reels holding approximately 300m. Each reel shall have a weather-resistant tag securely attached showing the length, nominal diameter, number of individual wires, and grade of the strand.

**6. Quality Assurance Program**

Along with the Bid the Bidder shall furnish quality assurance program of the manufacturer which includes the Quality System and the Quality Plans, which shall include, among others, information to meet the following requirement.

- i. The structure of the organization;
- ii. The duties and responsibilities assigned to staff ensuring quality of works;
- iii. The system for purchasing, taking delivery and verification of materials;

- iv. The system for ensuring quality of workmanship;
- v. The quality assurance arrangement shall conform to relevant requirements of ISO9000;
- vi. Statement giving list of important raw materials, names of manufacturer for the raw materials, list of standards according to which the raw materials are tested, list of test normally carried out on raw materials;
- vii. List of manufacturing facilities available;
- viii. List of areas in manufacturing process, where stage inspections are normally carried out for quality control and details of such tests and inspections;
- ix. List of testing equipment available with the manufacturer for final testing of equipment specified and the test plant limitation, if any, vis-à-vis the type, special, acceptance and routine tests specified in the relevant standards.

**7. Bid Documentation**

- 7.1 The Bidder shall provide with the Bid two (2) clear copies of the governing standards for fabrication and testing of stranded stay wire and two (2) clear copies of all other relevant standards referenced therein.
- 7.2 The Bidder shall provide a complete description, and catalogue of stranded stay wire.
- 7.3 The Bidder shall provide certified type test results of insulator pins as required by governing standards.
- 7.4 A clause-by-clause commentary on specification, specifying compliance and deviations, if any.
- 7.5 All data, drawings, catalogues and other technical documents shall be bound separately from the Bid documents.

**TABLE 1**

**RATING AND FEATURES**

Steel Wire Size (No. of wire/SWG)	7/12	7/8
Grade	700	700
Steel quality	45 ton	45 ton
Diameter of Wires, mm.	2.64	4.06
Minimum Weight, kg/km	300	720
Applicable Standard	B.S. 183 1972/(1983)	B.S. 183 1972/(1983)
Galvanization	IS: 2629-1985	IS: 2629-1985

## ***TECHNICAL DATA SHEET***

(To be completed by Bidder)

**Item:**                      **Steel Wire Strand**

	<i>Description</i>	<i>Unit</i>	<i>7/8 SWG</i>	<i>7/12 SWG</i>
1.	Manufacturer			
2.	Strand diameter (overall)	mm		
3.	No. of Strands			
4.	Minimum Breaking load	kg		
5.	Nominal diameter of coated wire in strand	mm		
6.	Left hand lay	Yes/No		
7.	Governing Standard for manufacturing and testing	Yes/No		
8.	Governing Standard for galvanization			
9.	Standards attached?	Yes/No		

Signed \_\_\_\_\_

On behalf of \_\_\_\_\_

Address \_\_\_\_\_

Date \_\_\_\_\_

### **SPECIFICATION: SP 4.3**

#### **GALVANISED STEEL BOLTS, NUTS AND MISCELLANEOUS FASTENING COMPONENTS**

##### **1. Scope**

- 1.1 This Specification covers the fabrication and supply of galvanized steel bolts and nuts, as specified herein, for use in overhead electric line construction.

##### **2. Material**

- 2.1 The bolts and nuts shall be manufactured and tested in accordance with IS: 1363 (Part I)-1984 or the latest version thereof or any other national or international standards that ensures at least equal or better quality to the standard mentioned above, will also be acceptable.

##### **3. General**

- 3.1 Bolts and nuts shall be furnished in the types, diameters and lengths specified in the Price Schedule. *However, the dimensions and length of threading of bolt must be confirmed with the Project prior to manufacture.*
- 3.2 Thread forms shall be consistent with all material/items listed herein and shall not strip or slip under sustained tensile loading equal to the design tensile strength of the threaded material item.
- 3.3 The manufacturer must have been accredited with ISO 9001:2000 with design and manufacturing quality certification.

##### **4. Machine Bolt and Nut**

- 4.1 Each machine bolt shall be furnished with two (2) hexagonal nuts and two (2) plain washers assembled thereon.

##### **5. Double-Arming Bolt and Nut**

- 5.1 Each double-arming bolt shall be furnished with four (4) hexagonal nuts and two (2) washers assembled thereon.

##### **6. Galvanizing**

- 6.1 The nut-bolts and ferrous materials in all other fastening components shall be galvanized after fabrication in accordance with IS: 2629-1985 or any revision thereof or other equivalent national or international standard provided that ensure at least equal or better quality to the standard mentioned above will also be acceptable.

**7. Tests**

- 7.1 The bolt and nut shall undergo type and routine tests in accordance with the relevant governing standard.

**8. Quality Assurance Program**

Along with the Bid the Bidder shall furnish quality assurance program of the manufacturer which includes the Quality System and the Quality Plans, which shall include, among others, information to meet the following requirement, failing which the Bid shall be liable for rejection.

- i. The structure of the organization;
- ii. The duties and responsibilities assigned to staff ensuring quality of works;
- iii. The system for purchasing, taking delivery and verification of materials;
- iv. The system for ensuring quality of workmanship;
- v. The quality assurance arrangement shall conform to relevant requirements of ISO9000;
- vi. Statement giving list of important raw materials, names of manufacturer for the raw materials, list of standards according to which the raw materials are tested, list of test normally carried out on raw materials;
- vii. List of manufacturing facilities available;
- viii. List of areas in manufacturing process, where stage inspections are normally carried out for quality control and details of such tests and inspections;
- ix. List of testing equipment available with the manufacturer for final testing of equipment specified and the test plant limitation, if any, vis-à-vis the type, special, acceptance and routine tests specified in the relevant standards.

**9. Bid Documentation**

- 9.1 The Bidder shall provide with the Bid two (2) clear copies of the governing standards for fabrication and testing of bolt and nut and two (2) clear copies of all other relevant standards referenced therein.
- 9.2 The Bidder shall provide certified type test results of bolt and nut as required by governing standards.
- 9.3 The Bidder shall provide catalogue and certified dimensional drawings of all types of bolt and nut.
- 9.4 A clause-by-clause commentary on specification, specifying compliance and deviations, if any.
- 9.5 All data, drawings, catalogues and other technical documents shall be bound separately from the Bid documents.

## ***TECHNICAL DATA SHEET***

(To be completed by Bidder)

**Item : Galvanized Steel Nuts and Bolts**

	<i>Description</i>	<i>Unit</i>
1.	Manufacturer	
2.	Material Description furnished?	Yes/No
3.	Governing Standard for manufacturing and testing	
4.	Governing Standard for galvanization	
5.	Standards attached?	Yes/No
6.	Catalog numbers attached for all items?	Yes/No

Signed \_\_\_\_\_  
On behalf of \_\_\_\_\_  
Address \_\_\_\_\_  
Date \_\_\_\_\_

**SPECIFICATION: SP 4.4****PREFORMED WIRE PRODUCTS****1. Scope**

This Specification covers the fabrication and supply of wire strand grips for stay set commonly used in overhead power line construction.

**2. Description**

- 2.1 The design of the preformed wire products specified herein shall be appropriate for the optimum combination of wire strand diameter, inside diameter, rod diameter, pitch diameter, number of pitch lengths, direction of lay, and raw materials of the specific application.
- 2.2 The manufacturer of the Preformed Wire Products must have been accredited with ISO 9001:2000 with design and manufacturing quality certification.
- 2.3 The preformed wire product shall be so designed to grip the designated surface evenly, with evenly-spaced gaps, and shall not bridge the gripped surface due to excessive number of strands in the grip or tie.

**3. Steel Wire Strand Grip for Stay Set**

- 3.1 The steel wire strand grip shall be designed for use with thimble eye or double eye stay rod and tightner fabricated in accordance with SPECIFICATION: SP4.1, stay wire fabricated in accordance with SPECIFICATION: SP4.2 (B.S. 183 1972/(1983)) and stay insulator fabricated in accordance with IS:5300-1969.
- 3.2 The steel wire strand grip shall be furnished for strand size and grade in accordance with Table 1.
- 3.3 The steel wire strand grip shall be manufactured of a galvanized steel wire in cabled loop form with long and short legs. The grip shall have a left-hand lay. Galvanizing shall be equivalent to Class C zinc coating per ASTM A-475.
- 3.4 The steel wire strand grip shall be color-coded for strand size and length and shall have one (1) or two (2) crossover marks for different diameter fittings. An identification tag shall be attached showing the manufacturer's catalogue number and applicable strand size.

**4. Tests**

The preformed wire products shall undergo type and routine tests in accordance with the relevant governing standard.

**5. Quality Assurance Program**

Along with the Bid the Bidder shall furnish quality assurance program of the manufacturer which includes the Quality System and the Quality Plans, which shall include, among others, information to meet the following requirement, failing which the Bid shall be liable for rejection.

- i. The structure of the organization;
- ii. The duties and responsibilities assigned to staff ensuring quality of works;
- iii. The system for purchasing, taking delivery and verification of materials;
- iv. The system for ensuring quality of workmanship;
- v. The quality assurance arrangement shall conform to relevant requirements of ISO9000;
- vi. Statement giving list of important raw materials, names of manufacturer for the raw materials, list of standards according to which the raw materials are tested, list of test normally carried out on raw materials;
- vii. List of manufacturing facilities available;
- viii. List of areas in manufacturing process, where stage inspections are normally carried out for quality control and details of such tests and inspections;
- ix. List of testing equipment available with the manufacturer for final testing of equipment specified and the test plant limitation, if any, vis-à-vis the type, special, acceptance and routine tests specified in the relevant standards.

**10. Bid Documentation**

- 10.1 The Bidder shall provide with the Bid two (2) clear copies of the governing standards for fabrication and testing of preformed wire products and two (2) clear copies of all other relevant standards referenced therein.
- 10.2 The Bidder shall provide certified type test results of preformed wire products as required by governing standards.
- 10.3 The Bidder shall provide complete description, and catalogue of preformed wire products.
- 10.4 A clause-by-clause commentary on specification, specifying compliance and deviations, if any.
- 10.5 All data, drawings, catalogues and other technical documents shall be bound separately from the Bid documents.

**TABLE 1**

**STEEL WIRE STRANDED GRIPS**

<b>Tie Application for Strand Size</b>	<b>Identification Tag and Color Code</b>	
7/8 SWG	GS-1	Red
7/12 SWG	GS-2	Blue

Note: All designations shown are used for product identification for the purpose of this IFB.

**TECHNICAL DATA SHEET**

(To be completed by Bidder)

**Item: Preformed Wire Products (Steel Wire Strand Grip)**

	<i>Description</i>	<i>Unit</i>
1.	Manufacturer	
2.	Material Description furnished?	Yes/No
3.	Governing Standard for manufacturing and testing	
4.	Governing Standard for galvanization	
5.	Standards attached?	Yes/No
6.	Catalogue numbers attached for all items?	Yes/No
7.	Bidder certifies that steel strand grip offered is suitable for use with insulator, stay set and stay wire specified in SPECIFICATIONS: SP3.1.1, SP3.2.1 and SP3.2.2 respectively	Yes/No
8.	Holding rating of grip	kg
	a) 7/8 SWG	
	b) 7/12 SWG	

Signed \_\_\_\_\_

On behalf of \_\_\_\_\_

Address \_\_\_\_\_

Date \_\_\_\_\_

**SPECIFICATION: SP 4.5.1**

**GROUND RODS AND CLAMPS**

**1. Scope**

This Specification covers the fabrication and supply of galvanized steel ground rods and clamps for use in overhead power line construction.

**2. Description**

Ground Rod

- 2.1 The ground rod shall be made of high carbon, open-hearth steel so as to achieve maximum strength. It shall be hot dip galvanized.
- 2.2 The ground rod shall be 19mm in diameter and 4,000 mm in overall length.
- 2.3 The driven end of the ground rod shall have a truncated cone point. The cone point shall be approximately 13mm long, measured along the axis of the ground rod. The driving head of the ground rod shall have an approximate 3 mm, 45 degrees chamfer.
- 2.3 The manufacturing process shall assure that ground rod does not bend when driven into hard soils.

Ground Rod Clamp

- 2.5 The ground rod clamp shall be heavy duty forged steel clamp provided with a hex head cup point set screw of high strength steel with machine-cut threads. It shall be so manufactured that it gives low resistance connection. The ground rod clamp shall be galvanized.
- 2.6 The clamp shall suitably accommodate and clamp a 19 mm. ground rod and a stranded grounding conductor of 7/12 SWG size (SPECIFICATION: SP 4.5.2).

**3. Galvanizing**

- 3.1 The galvanization of ground rod and clamp shall be in accordance with IS: 2629-1985 or any revision thereof or other equivalent national or international standard provided that ensure at least equal or better quality to the standard mentioned above will also be acceptable.

**4. Tests**

Grounds rods and clamps shall undergo type and routine tests in accordance with the relevant governing standard.

**5. Quality Assurance Program**

- 5.1 The manufacturer must have been accredited with ISO 9001:2000 with design and manufacturing quality certification.
- 5.2 Along with the Bid the Bidder shall furnish quality assurance program of the manufacturer which includes the Quality System and the Quality Plans, which shall include, among others, information to meet the following requirement, failing which the Bid shall be liable for rejection.
- i. The structure of the organization;
  - ii. The duties and responsibilities assigned to staff ensuring quality of works;
  - iii. The system for purchasing, taking delivery and verification of materials;
  - iv. The system for ensuring quality of workmanship;
  - v. The quality assurance arrangement shall conform to relevant requirements of ISO9000;
  - vi. Statement giving list of important raw materials, names of manufacturer for the raw materials, list of standards according to which the raw materials are tested, list of test normally carried out on raw materials;
  - vii. List of manufacturing facilities available;
  - viii. List of areas in manufacturing process, where stage inspections are normally carried out for quality control and details of such tests and inspections;
  - ix. List of testing equipment available with the manufacturer for final testing of equipment specified and the test plant limitation, if any, vis-à-vis the type, special, acceptance and routine tests specified in the relevant standards.

**6. Bid Documentation**

- 6.1 The Bidder shall provide with the Bid two (2) clear copies of the governing standards for fabrication and testing of grounding rod and clamp and two (2) clear copies of all other relevant standards referenced therein.
- 6.2 The Bidder shall provide certified type test results of ground rods and clamps as required by governing standards.
- 6.3 The Bidder shall provide catalogue and certified dimensional drawings of all types of ground rods and clamps.
- 6.4 A clause-by-clause commentary on specification, specifying compliance and deviations, if any.
- 6.5 All data, drawings, catalogues and other technical documents shall be bound separately from the Bid documents.

**TECHNICAL DATA SHEET**

(To be completed by Bidder)

**Item:                                      Ground (Earth Rods and Clamps)**

	<i>Description</i>	<i>Unit</i>
1.	Manufacturer	
2.	Material Description furnished?	Yes/No
3.	Governing Standard for manufacturing and testing	
4.	Governing Standard for galvanization	
5.	Standards attached?	Yes/No
6.	Catalogue/ dimensional drawings attached for all items?	Yes/No
7.	Dimensions (Ground Rod):	
	Length	mm.
	Diameter	mm.
8.	Catalogue number	
	Rod	
	Clamp	
9.	Copies of type test results attached?	Yes/No

Signed \_\_\_\_\_

On behalf of \_\_\_\_\_

Address \_\_\_\_\_

Date \_\_\_\_\_

**SPECIFICATION: SP 4.5.2****GROUNDING CONDUCTOR****1. Scope**

This specification covers the fabrication and supply of galvanized stranded steel grounding conductor for use in the neutral grounding of distribution transformers and body grounding of electrical equipment.

**2. Description**

2.1 The conductor shall be 7-wire stranded conductor and shall conform to the characteristics as specified in Table 1 contained herein. Stranded conductor shall be galvanized.

2.2 The manufacturer of ground Conductor must have been accredited with ISO 9001:2000 with design and manufacturing quality certification.

**3. Galvanizing**

3.1 The grounding conductor shall be galvanized after fabrication in accordance with IS: 2629-1985 or any revision thereof or any other national or international standards that ensure at least equal or better quality to the standard mentioned above will also be acceptable.

**4. Tests**

The grounding conductor shall undergo type and routine tests in accordance with the relevant governing standard.

**5. Quality Assurance Program**

Along with the Bid the Bidder shall furnish quality assurance program of the manufacturer which includes the Quality System and the Quality Plans, which shall include, among others, information to meet the following requirement, failing which the Bid shall be liable for rejection.

- i. The structure of the organization;
- ii. The duties and responsibilities assigned to staff ensuring quality of works;
- iii. The system for purchasing, taking delivery and verification of materials;
- iv. The system for ensuring quality of workmanship;
- v. The quality assurance arrangement shall conform to relevant requirements of ISO9000;
- vi. Statement giving list of important raw materials, names of manufacturer for the raw materials, list of standards according to which the raw materials are tested, list of test normally carried out on raw materials;
- vii. List of manufacturing facilities available;
- viii. List of areas in manufacturing process, where stage inspections are normally carried out for quality control and details of such tests and inspections;

- ix. List of testing equipment available with the manufacturer for final testing of equipment specified and the test plant limitation, if any, vis-à-vis the type, special, acceptance and routine tests specified in the relevant standards.

**6. Bid Documentation**

- 6.1 The Bidder shall provide with the Bid two (2) clear copies of the governing standards for fabrication and testing of grounding conductor and two (2) clear copies of all other relevant standards referenced therein.
- 6.2 The Bidder shall provide a complete description, and catalogue of grounding conductor.
- 6.3 The Bidder shall provide certified type test results of grounding conductor as required by governing standards.
- 6.4 A clause-by-clause commentary on specification, specifying compliance and deviations, if any.
- 6.5 All data, drawings, catalogues and other technical documents shall be bound separately from the Bid documents.

**TABLE 1**

**GROUNDING CONDUCTOR MINIMUM REQUIREMENTS**

	7-No. 12 SWG
Diameter of single strand	2.67 mm
Weight	299 kg/km
Short time fusing current	12 kA
Resistivity	15 Micro-Ohm-cm

***TECHNICAL DATA SHEETS***

(To be completed by Bidder)

**Item: Grounding Conductor**

<i>Description</i>	<i>Unit</i>
1. Manufacturer	
2. Governing Standard for manufacturing and testing	
3. Governing Standard for galvanization	
4. Standards attached?	Yes/No
5. Diameter	mm
6. Cross Section	sq. mm
7. Short time fusing 30 cycles	Amps
8. Weight (Approx.)	kg/km
9. Resistance 20 degree C (Approx.)	ohms/km

Signed \_\_\_\_\_  
On behalf of \_\_\_\_\_  
Address \_\_\_\_\_  
Date \_\_\_\_\_

### **SPECIFICATION: SP 4.5.3**

#### **BANDING MATERIALS AND TOOLS**

##### **1. Scope**

This specification covers the supply of banding strap, buckles and application tools commonly applied as a fastening and binding system.

##### **2. Description**

###### Banding Strap and Buckle

2.1 The banding strap and buckle shall be made of stainless steel, and shall be:

- a) Type 1: 19 mm. in width and 0.7 mm in thickness. Minimum breaking strength of the strap shall be 1250 kg minimum. The strap shall be come on strap winder made of weather resistant plastic. The strap winder shall have handle for carrying, box for buckles and it shall be suitable for field handling. One roll shall contain 50 m. of banding strap. Buckle shall be suitable for use with banding strap.
- b) Type 2: 13 mm. in width and 0.7 mm. in thickness. Minimum breaking strength of the strap shall be 850 kg minimum. The strap shall be come on strap winder made of weather resistant plastic. The strap winder shall have handle for carrying, box for buckles and it shall be suitable for field handling. One roll shall contain 50 m. of banding strap. Buckle shall be suitable for use with banding strap.

###### Tools for application of banding strap and buckle

2.2 Tools for application of banding strap and buckle shall be suitably designed and sized for use with stainless steel banding and buckle described in paragraph 2.1 above. The tool shall be durable and suitable for long-term outdoor use.

##### **3. Tests**

The binding materials shall undergo type and routine tests in accordance with the relevant governing standard.

##### **4. Quality Assurance Program**

4.1 The manufacturer of the banding materials and tools must have been accredited with ISO 9001:2000 with design and manufacturing quality certification.

4.1 Along with the Bid the Bidder shall furnish quality assurance program of the manufacturer which includes the Quality System and the Quality Plans, which shall include, among others, information to meet the following requirement, failing which the Bid shall be liable for rejection.

- i. The structure of the organization;

- ii. The duties and responsibilities assigned to staff ensuring quality of works;
- iii. The system for purchasing, taking delivery and verification of materials;
- iv. The system for ensuring quality of workmanship;
- v. The quality assurance arrangement shall conform to relevant requirements of ISO9000;
- vi. Statement giving list of important raw materials, names of manufacturer for the raw materials, list of standards according to which the raw materials are tested, list of test normally carried out on raw materials;
- vii. List of manufacturing facilities available;
- viii. List of areas in manufacturing process, where stage inspections are normally carried out for quality control and details of such tests and inspections;
- ix. List of testing equipment available with the manufacturer for final testing of equipment specified and the test plant limitation, if any, vis-à-vis the type, special, acceptance and routine tests specified in the relevant standards.

**5. Bid Documentation**

- 5.1 The Bidder shall provide with the Bid two (2) clear copies of the governing standards for fabrication and testing of banding materials and tools.
- 5.2 The Bidder shall provide a complete description, and catalogue of banding materials and tools.
- 5.3 The Bidder shall provide certified type test results of banding materials and tools as required by governing standards.
- 5.4 A clause-by-clause commentary on specification, specifying compliance and deviations, if any.
- 5.5 All data, drawings, catalogues and other technical documents shall be bound separately from the Bid documents.

***TECHNICAL DATA SHEET***

(To be completed by the Bidder)

**Item:**                      **Banding Material and Tools**

	<i>Description</i>	<i>Unit</i>
1.	Manufacturer	
2.	Catalogue number	
	13 mm size	
	19 mm size	
3.	Minimum Breaking Strength	
	13 mm size	kg
	19 mm size	kg

Signed \_\_\_\_\_  
On behalf of \_\_\_\_\_  
Address \_\_\_\_\_  
Date \_\_\_\_\_

## **SPECIFICATION: SP 4.6**

### **HDPE PIPE and PPR PIPES**

**1. Scope**

This Specification covers the fabrication and supply of 140 mm Flexible HDPE Pipe and PPR Pipes used for 300 sq mm XLPE power cable in underground 11kV distribution system.

**2. Description**

The HDPE pipes are black and PPR are green in colour processing smooth internal and external surface which should be suitable for inserting cable.

The HDPE pipes shall be fabricated and tested in accordance with BS: 3412, Class N HDPE or any revision thereof or other equivalent national or international standard provided that ensure at least equal or better quality to the standard mentioned above will also be acceptable. The minimum tensile strength of the pipe shall be 240 kg/cm<sup>2</sup>.

The HDPE pipe should be suitable for 4 kgf/cm<sup>2</sup> pressures with thickness not less than 6.5 mm and weight of the HDPE pipe should not be less than 2.5 kg per meter. The HDPE pipe shall have a minimum tensile strength of 3200 kg/mm<sup>2</sup>. The carbon content should not increase more than 2.5% in total. The HDPE pipes should have design at 27 deg C for a stress of over 50 kg/cm<sup>2</sup> with safety factor of 1.3.

The PPR pipes shall be fabricated and tested in accordance with EN ISO 15874, Class PN20 and PN25 or any revision thereof or other equivalent national or international standard provided that ensure at least equal or better quality to the standard mentioned above will also be acceptable. The specific chemical structure of green PPR should be present to provide the well balanced mechanical properties and superior long term heat resistance.

**3. Tests**

The type test and routine tests shall be carried out for the materials to be supplied according to the above mentioned technical specification in accordance with the governing standard.

**4. Packaging**

The packing should be done for the materials to be supplied accordingly.

**5. Quality Assurance Program**

Along with the Bid the Bidder shall furnish quality assurance program of the manufacturer which includes the Quality System and the Quality Plans, which shall include, among others, information to meet the following requirement.

- i. The structure of the organization;
- ii. The duties and responsibilities assigned to staff ensuring quality of works;
- iii. The system for purchasing, taking delivery and verification of materials;
- iv. The system for ensuring quality of workmanship;
- v. The quality assurance arrangement shall conform to relevant requirements of ISO9001; 2008
- vi. Statement giving list of important raw materials, names of manufacturer for the raw materials, list of standards according to which the raw materials are tested, list of test normally carried out on raw materials;
- vii. List of manufacturing facilities available;
- viii. List of areas in manufacturing process, where stage inspections are normally carried out for quality control and details of such tests and inspections;
- ix. List of testing equipment available with the manufacturer for final testing of equipment specified and the test plant limitation, if any, vis-à-vis the type, special, acceptance and routine tests specified in the relevant standards.

**6. Bid Documentation**

- 6.1 The Bidder shall provide with the Bid two (2) clear copies of the governing standards for fabrication and testing of materials and two (2) clear copies of all other relevant standards referenced therein.
- 6.2 The Bidder shall provide a complete description, and catalogue of materials.
- 6.3 The Bidder shall provide certified test report as required by governing standards for materials.
- 6.4 A clause-by-clause commentary on specification, specifying compliance and deviations, if any.
- 6.5 All data, drawings, catalogues and other technical documents shall be bound separately from the Bid documents.

**SPECIFICATION: SP 5.1**

**CROSSARMS AND BRACING ANGLES**

**1. Scope**

This Specification covers the fabrication and supply of galvanized steel cross-arms and bracing members commonly used in overhead power line construction.

**2. Material**

2.1 The steel cross-arms shall be fabricated from hot-rolled channels and angles.

2.2 The steel channels and angles shall be fabricated and tested in accordance with Indian Standards IS: 226-1975 and IS-808-1964 or any revision thereof or other equivalent national or international standard provided that ensure at least equal or better quality to the standard mentioned above will also be acceptable. The minimum tensile strength of the steel shall be 4200 kg/cm<sup>2</sup>.

**3. Description**

3.1 The steel cross-arms and bracing angles shall be of sizes shown in the Table 1: Cross-arms and bracing angles, contained herein.

3.2 Conceptual hole pattern and size of holes on cross-arm channels are shown in appropriate drawings herein, however, the Supplier must confirm with the Project the locations and sizes of holes prior to the manufacture.

3.3 The surface of the steel shall be flat after drilling or (punching) and free of dimpling or imperfections. The hole edges shall be broken by reaming. The holes shall be full dimension after galvanizing and no minus tolerance of specified hole size will be accepted.

3.3 The steel cross-arm and bracing angles shall be furnished reasonably smooth on all surfaces and free of burrs or sharp projections.

**4. Galvanizing**

4.1 The steel cross-arms and bracing angles shall be galvanized after fabrication in accordance with IS: 2629-1985 or any revision thereof or other equivalent national or international standard provided that ensure at least equal or better quality to the standard mentioned above will also be acceptable..

**5. Tests**

5.1 Apart from the tests indicated herein in the referenced standards, the channels and angles shall undergo following tests:

- Visual Inspection;
- Verification of Dimensions;

**6. Quality Assurance Program**

Along with the Bid the Bidder shall furnish quality assurance program of the manufacturer which includes the Quality System and the Quality Plans, which shall include, among others, information to meet the following requirement, failing which the Bid shall be liable for rejection.

- i. The structure of the organization;
- ii. The duties and responsibilities assigned to staff ensuring quality of works;
- iii. The system for purchasing, taking delivery and verification of materials;
- iv. The system for ensuring quality of workmanship;
- v. The quality assurance arrangement shall conform to relevant requirements of ISO9000;
- vi. Statement giving list of important raw materials, names of manufacturer for the raw materials, list of standards according to which the raw materials are tested, list of test normally carried out on raw materials;
- vii. List of manufacturing facilities available;
- viii. List of areas in manufacturing process, where stage inspections are normally carried out for quality control and details of such tests and inspections;
- ix. List of testing equipment available with the manufacturer for final testing of equipment specified and the test plant limitation, if any, vis-à-vis the type, special, acceptance and routine tests specified in the relevant standards.

**7. Bid Documentation**

- 7.1 The Bidder shall provide with the Bid two (2) clear copies of the governing standards for fabrication and testing of channels and angles and two (2) clear copies of all other relevant standards referenced therein.
- 7.2 The Bidder shall provide a complete description, catalogue and certified dimensional drawings of all channels and angles.
- 7.3 A clause-by-clause commentary on specification, specifying compliance and deviations, if any.
- 7.4 All data, drawings, catalogues and other technical documents shall be bound separately from the Bid documents.

TABLE 1: STEEL CROSSARM CHANNELS AND ANGLE BRACES

<i>S.NO.</i>	<i>Description</i>	<i>Type</i>	<i>Dimension in mm.</i>	<i>Ref. DWG.</i>
1.	11 kV, Single Pole, Triangular: 1.1 Pole Top 1.2 Standard	Channel Channel	100x50x6.4x5x300 100x50x6.4x5x1200	DWG.8H DWG.9H
2.	11 kV, Double Pole: 2.1 Standard 2.2 Bracing Member 2.3 Bracing Member	Channel Angle Angle	100x50x6.4x5x2390 40x40x5x2071 40x40x5x2719	DWG.10H DWG.11H DWG.11H
3.	Transformer Platform Complete set	Channel Channel	100x50x6.4x5x2500 100x50x6.4x5x1200	CS11- TRN-05
4.	Lightning Arrester and Cut-out Support (at Transformer Platform): 4.1 Support	Channel	100x50x6.4x5x2348	DWG.15H

***TECHNICAL DATA SHEETS***

(To be completed by Bidder)

**Item:** **Cross-arm and angle**

<b><i>Description</i></b>		<b><i>Unit</i></b>
1.	Manufacturer	
2.	Steel Classification	
3.	Minimum tensile strength of steel	
4.	Is the cross arm and angles fabricated from hot-rolled steel sections?	Yes/No
5.	Governing Standard	
6.	Standard attached?	Yes/No
6.	Governing Standard for galvanizing	
7.	Drawings of cross arm and bracing?	Yes/No

Signed \_\_\_\_\_  
On behalf of \_\_\_\_\_  
Address \_\_\_\_\_  
Date \_\_\_\_\_

**SPECIFICATION: SP 5.2**

**FLAT CROSSARM BRACE**

**1. Scope**

This Specification covers the fabrication, testing and supply of flat, galvanized steel cross-arm braces.

**2. Material**

- 2.1 The flat cross-arms brace shall be fabricated out of hot rolled steel flat.
- 2.2 The steel flat for cross-arms brace shall be fabricated and tested in accordance with Indian Standards IS: 226-1975, and IS-1731-1971 or any revision thereof or other equivalent national or international standard provided that ensure at least equal or better quality to the standard mentioned above will also be acceptable. The minimum tensile strength of the steel shall be 4200 kg/cm<sup>2</sup>.

**3. Description**

- 3.1 The brace shall be furnished reasonably smooth on all surfaces and free of burrs or sharp projections.
- 3.3 The surface of the steel shall be flat after drilling or (punching) and free of dimpling or imperfections. The hole edges shall be broken by reaming. The holes shall be full dimension after galvanizing and no minus tolerance of specified hole size will be accepted.
- 3.3 The brace shall have a minimum tensile strength of 3182 kg at the bolt-hole and bolt slot.
- 3.4 The brace shall be capable of being bent 10 degrees at the bolt hole or slot and 140 degrees at any point between hole and slot without cracking of the base metal on the outside of bent portion.
- 3.5 The brace shall be drilled and dimensioned in accordance with Dwg.7H attached herein.

**4. Galvanizing**

- 4.1 The flat cross arm brace shall be hot dipped galvanized after fabrication in accordance with IS: 2629-1985 or any revision thereof or other equivalent national or international standard provided that ensure at least equal or better quality to the standard mentioned above will also be acceptable.

## **5. Tests**

Apart from the tests indicated herein in the referenced standards, the flat cross arm brace shall undergo following tests:

- Visual Inspection;
- Verification of Dimensions;

## **6. Quality Assurance Program**

Along with the Bid the Bidder shall furnish quality assurance program of the manufacturer which includes the Quality System and the Quality Plans, which shall include, among others, information to meet the following requirement, failing which the Bid shall be liable for rejection.

- i. The structure of the organization;
- ii. The duties and responsibilities assigned to staff ensuring quality of works;
- iii. The system for purchasing, taking delivery and verification of materials;
- iv. The system for ensuring quality of workmanship;
- v. The quality assurance arrangement shall conform to relevant requirements of ISO9000;
- vi. Statement giving list of important raw materials, names of manufacturer for the raw materials, list of standards according to which the raw materials are tested, list of test normally carried out on raw materials;
- vii. List of manufacturing facilities available;
- viii. List of areas in manufacturing process, where stage inspections are normally carried out for quality control and details of such tests and inspections;
- ix. List of testing equipment available with the manufacturer for final testing of equipment specified and the test plant limitation, if any, vis-à-vis the type, special, acceptance and routine tests specified in the relevant standards.

## **7. Bid Documentation**

- 7.1 The Bidder shall provide with the Bid two (2) clear copies of the governing standards for fabrication and testing of flat cross arm brace and two (2) clear copies of all other relevant standards referenced therein.
- 7.2 The Bidder shall provide a complete description, catalogue and certified dimensional drawings of flat cross arm brace.
- 7.3 A clause-by-clause commentary on specification, specifying compliance and deviations, if any.
- 7.4 All data, drawings, catalogues and other technical documents shall be bound separately from the Bid documents.

## ***TECHNICAL DATA SHEETS***

(To be completed by Bidder)

**Item:** **Flat cross-arm brace**

<b><i>Description</i></b>	<b><i>Unit</i></b>
1. Manufacturer	
2. Steel Classification	
3. Minimum tensile strength of steel	
4. Is the flat cross arm brace fabricated from hot-rolled steel sections?	Yes/No
5. Governing Standard for manufacturing and testing	
6. Governing Standard for galvanizing	
7. Standards attached?	Yes/No
8. Drawings of flat cross arm brace?	Yes/No

Signed \_\_\_\_\_

On behalf of \_\_\_\_\_

Address \_\_\_\_\_

Date \_\_\_\_\_

**SPECIFICATION: SP 5.3**

**TRANSFORMER PLATFORMS**

**1. Scope**

- 1.1 This specification covers the fabrication and supply of transformer platforms used in overhead power line construction.

**2. Material**

- 2.1 The transformer platform shall be fabricated from hot-rolled channels, angles and steel members.
- 2.2 The steel channels and angles for transformer platform shall be fabricated in accordance with Indian Standards IS: 226-1975 and IS-808-1964 or any revision thereof or other equivalent national or international standard provided that ensure at least equal or better quality to the standard mentioned above will also be acceptable. The minimum tensile strength of the steel shall be 4200 kg/cm<sup>2</sup>.

**3. Description**

- 3.1 The platform shall be fabricated out of galvanized steel members, field assembled by bolting.
- 3.2 The platform will support the transformer above the ground and will be supported by two-pole structures of tubular steel or pre-stressed concrete (PSC) poles. Transformers will be bolted to the platform at four (4) points. Provision should be made for the mounting of transformers of different physical dimensions and ratings up to 300 kVA.
- 3.3 The platform shall be designed by the supplier and fabricated, in general, in accordance with the conceptual configuration shown in Dwg. CS11-TRN-05 contained herein. The design shall provide support for a transformer of a minimum of 1500 kg in weight with a minimum safety factor of 2.0. The Platform shall be stiff and shall be capable of withstanding horizontal forces and an overturning moment due to seismic effects on a transformer with centre of gravity 0.5 meter above its base and seismic horizontal acceleration of 0.4g. The platform shall be stiff and shall not visibly deflect under static loading.
- 3.4 The platform shall be supplied disassembled, complete with all required members and fastenings. Packing may be made by banding structural members. Fastenings shall be separately packed. Structural members shall be clearly identified for ease of assembly in accordance with the assembly drawing furnished by the supplier.
- 3.5 The platform shall be suitable for fixing to support tubular poles of 150 to 250 mm diameter, and o PSC poles of rectangular section with 250 to 350 mm in width and 140 to 180 mm depth.

**4. Galvanizing**

- 4.1 All ferrous parts of transformer platform shall be galvanized after fabrication in accordance with IS: 2629-1985 or any revision thereof or other equivalent national or international standard provided that ensure at least equal or better quality to the standard mentioned above will also be acceptable.

**5. Tests**

- 5.1 Apart from the tests indicated herein in the referenced standards, the transformer platform shall undergo following tests:
- Visual Inspection;
  - Verification of Dimensions;

**6. Quality Assurance Program**

Along with the Bid the Bidder shall furnish quality assurance program of the manufacturer which includes the Quality System and the Quality Plans, which shall include, among others, information to meet the following requirement, failing which the Bid shall be liable for rejection.

- i. The structure of the organization;
- ii. The duties and responsibilities assigned to staff ensuring quality of works;
- iii. The system for purchasing, taking delivery and verification of materials;
- iv. The system for ensuring quality of workmanship;
- v. The quality assurance arrangement shall conform to relevant requirements of ISO9000;
- vi. Statement giving list of important raw materials, names of manufacturer for the raw materials, list of standards according to which the raw materials are tested, list of test normally carried out on raw materials;
- vii. List of manufacturing facilities available;
- viii. List of areas in manufacturing process, where stage inspections are normally carried out for quality control and details of such tests and inspections;
- ix. List of testing equipment available with the manufacturer for final testing of equipment specified and the test plant limitation, if any, vis-à-vis the type, special, acceptance and routine tests specified in the relevant standards.

**7. Bid Documentation**

- 7.1 A preliminary design of the platform shall be submitted with the Bid. Data to be supplied with the preliminary design shall be:
- a) Steel classification proposed to be used and the characteristics thereof;
  - b) Two copies of Preliminary detail drawings of the proposed platform;

- c) Data regarding:
  - i) Vertical and horizontal loading on poles,
  - ii) Resultant safety factor,
  - iii) Resultant deflection,
  - iv) Resultant percent of allowable tension, compression, and shear limits for the steel selected and associated fastening,
  - v) Moments on pole due to seismic effects on the platform and transformers.
- 7.2 A clause-by-clause commentary on specification, specifying compliance and deviations, if any.
- 7.3 All data, drawings, catalogues and other technical documents shall be bound separately from the Bid documents.

***TECHNICAL DATA SHEET***

(To be completed by the Bidder)

**Item: Transformer Platform**

<i>Description</i>	<i>Unit</i>
1. Manufacturer	
2. Preliminary details dwg. furnished?	Yes/No
3. Steel Classification/ Characteristics furnished?	Yes/No
4. Governing Standard for galvanization	
5. Vertical Load on pole	
6. Resultant Safety Factor	
7. Resultant Deflection at design load	mm
8. % of allowable tension	
9. % of allowable compression	
10. % of allowable shear limits	

Signed \_\_\_\_\_

On behalf of \_\_\_\_\_

Address \_\_\_\_\_

Date \_\_\_\_\_

## **SPECIFICATION: SP 5.4**

### **POLE CLAMPS**

#### **1. Scope**

- 1.1 This Specification covers the fabrication and supply of galvanized steel pole clamps with nuts, bolts and washers for use on overhead power line construction.

#### **2. Material**

- 2.1 The pole clamp shall be fabricated out of hot-rolled steel flat.
- 2.2 The steel flat for pole clamp shall be fabricated and tested in accordance with Indian Standards IS: 226-1975, and IS-1731-1971 or any revision thereof or other equivalent national or international standard provided that ensure at least equal or better quality to the standard mentioned above will also be acceptable. The minimum tensile strength of the steel shall be 4200 kg/cm<sup>2</sup>.

#### **3. Description**

- 3.1 Outline details of pole clamps are shown in the drawings DWG.1H - DWG.4H. Dimensions may be changed to comply with the final pole sizes selected. Therefore, the dimensions must be confirmed with the Project prior to manufacture.
- 3.2 Two (2) numbers of galvanized, 16 mm. (dia.) X 60mm. (length), fully threaded bolts with two (2) nuts and washers shall be provided with each pole clamp.
- 3.3 The fittings shall be free of burrs, splinters, splits, sharp points and edges, which may damage conductors or show evidence of poor workmanship.
- 3.4 The surface of the steel shall be flat after drilling or (punching) and free of dimpling or imperfections. The hole edges shall be broken by reaming. The holes shall be full dimension after galvanizing and no minus tolerance of specified hole size will be accepted.
- 3.5 The pole clamps shall have a minimum tensile strength of 3182 kg at the bolt-hole and bolt slot.

#### **4. Galvanizing**

- 4.1 The pole clamps and nut, bolts and washers shall be galvanized after fabrication in accordance with IS: 2629-1985 or any revision thereof or other equivalent national or international standard provided that ensure at least equal or better quality to the standard mentioned above will also be acceptable.

#### **5. Tests**

5.1 Apart from the tests indicated herein in the referenced standards, the pole clamps shall undergo following tests:

- Visual Inspection;
- Verification of Dimensions;

**6. Quality Assurance Program**

Along with the Bid the Bidder shall furnish quality assurance program of the manufacturer which includes the Quality System and the Quality Plans, which shall include, among others, information to meet the following requirement, failing which the Bid shall be liable for rejection.

- i. The structure of the organization;
- ii. The duties and responsibilities assigned to staff ensuring quality of works;
- iii. The system for purchasing, taking delivery and verification of materials;
- iv. The system for ensuring quality of workmanship;
- v. The quality assurance arrangement shall conform to relevant requirements of ISO9000;
- vi. Statement giving list of important raw materials, names of manufacturer for the raw materials, list of standards according to which the raw materials are tested, list of test normally carried out on raw materials;
- vii. List of manufacturing facilities available;
- viii. List of areas in manufacturing process, where stage inspections are normally carried out for quality control and details of such tests and inspections;
- ix. List of testing equipment available with the manufacturer for final testing of equipment specified and the test plant limitation, if any, vis-à-vis the type, special, acceptance and routine tests specified in the relevant standards.

**7. Bid Documentation**

7.2 The Bidder shall provide a complete description, catalogue and two (2) copies of certified dimensional drawings of pole clamps.

7.3 A clause-by-clause commentary on specification, specifying compliance and deviations, if any.

7.4 All data, drawings, catalogues and other technical documents shall be bound separately from the Bid documents.

***TECHNICAL DATA SHEETS***

(To be completed by Bidder)

**Item:**                      **Pole Clamps**

	<b><i>Description</i></b>	<b><i>Unit</i></b>
1.	Manufacturer	
2.	Steel Classification	
3.	Governing Standard for galvanization	
4.	Drawings of Pole Clamp furnished?	Yes/No

Signed \_\_\_\_\_  
On behalf of \_\_\_\_\_  
Address \_\_\_\_\_  
Date \_\_\_\_\_



**Section VI-D**  
**CONSTRUCTION STANDARDS**

## **CONSTRUCTION STANDARDS**

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## **1.0 GENERAL INSTRUCTIONS**

### **A. General**

The general instructions included in this section shall be applied to all 11 kV and 400/230 volt overhead line construction under this Project. Additional general instructions are included in each section as they are applied specifically to the subject covered in that section.

These construction standards provide basic requirements for new facilities.

The clearances of conductors and structures shall be as per the construction standard drawing no. CSG-01, CSG-02 and CSG-03.

Deviations from these standards may become necessary due to unique or special conditions. In such cases, the directions of the Employer shall be followed.

The safety rules of the NEA shall be strictly observed at all times by the Contractors' and NEA's work forces.

### **B. Pole numbering**

Poles and structures shall be numbered in accordance with a numbering system provided by NEA. Each pole or structure shall be paint stencilled with the assigned number.

## **2.0 POLES, CROSSARMS, AND STAYS**

### **A. Poles**

Poles shall be installed by length and class at locations in accordance with the construction plan.

### **B. Pole setting**

Pole holes shall be dug large enough in diameter to admit a tamping bar all around the periphery of the pole and shall have a uniform dimension as per the type of pole used at the top and bottom. Poles shall be planted in the ground to the depth specified in Table 2. Before planting a pole, the bottom of the hole made for planting the pole, shall be cleaned of free soil and firmly tamped, to prevent the hole from settling.

The stability of a pole, particularly a pole without stay, is greatly influenced by the size of the pole hole, the nature of the soil and the care exercised in back filling and tamping. Two active hand tampers and one slow shoveler shall result in good compaction.

Poles shall be set to stand perpendicular except at terminals, angles and other points of excessive strain where they shall be given a rake not to exceed 10 centimetres against the direction of strain. Poles located at the sides of banks or other locations, where washouts may occur, shall be protected by suitable cribbing, or shall be referred to the Engineer for recommended action.

After the pole is in position and the hole is back filled and tamped, soil shall be piled and packed firmly around the pole. Pole setting shall be inspected prior to acceptance and any back fills that have sunk shall be refilled.

Poles located in shallow river beds shall be protected by gabions as designated by the Employer. Gabions should be approximately 2 metres x 1 metre x metre. Four such gabions are required for each pole.

Set pole and pour 860 mm diameter foundation and level areas around pole and set gabions in pattern shown in CSG-06. It is important to lace adjacent gabions together along the perimeter of all contact surfaces. Fill gabions with hard, durable, clean stone, 100 mm to 200 mm in size in three layers. Install two connecting wires at each layer. Lace gabion lids securely and make certain that all edges are closed. Fill void between pole and gabion with hard, durable, clean rock 200 mm minimum size.

### **C. Pole Framing**

Pole and structures shall generally be framed in accordance with these standards and the construction structure data sheets. Where special framing requirements are necessary, the Employer shall provide framing instructions for the specific structure.

Each cross-arm shall be attached to the pole by a pole clamp or by machined bolts of sufficient length to pass completely through the holes provided on the pole and cross-arms and receive their full complement of nuts.

Bolts of proper length shall be used. Excess nuts shall not be used to make use of a bolt which would otherwise be too long. The end of a machined bolt projecting more than 3 centimetres beyond the nut shall be cut off to a length of 2 centimetres beyond the nut. Each bolt, when installed, shall have its full complement of nuts.

#### **D. Stays**

Stay leads specified in construction documents are defined as the horizontal distance from the centre line of the pole at ground line to the point where the anchor rod should enter the ground assuming the ground to be level. For the correction in stay leads for uneven ground see Drawing No. CSG-11.

The Engineer, upon request, may designate the actual location of stay anchor rods on slope of hills. The stay stake indicates the point where the anchor rod enters the ground. The anchor hole shall be dug accordingly.

The attachment of one stay shall not overlap that of another stay when two or more stays are carried to a pole or anchor. Each shall be entirely independent of the other. This does not prevent the use of multiple eye rods for nuts designed for such use.

All stays to be installed on a pole line shall be placed and drawn reasonably tight before the conductors are tensioned. After the conductors are tensioned and sagged to their final position, the stays shall be carefully inspected to see that each is carrying its share of the load on the pole as intended. If multiple stays are not carrying equal strain, the slack stay shall be pulled up until it is sharing load as intended.

Stay anchors must be installed full depth and set to pull against undisturbed soil to develop full tension. An anchor not properly installed will move and allow movement of the top of the pole, thus slacking the conductors. Stay anchors installed in soft or unstable earth shall be placed at specified depth and back filled with 5 cm. maximum size crushed stone placed to a depth of 1 meter from the bottom of the pole.

#### **E. Stay Insulators**

Stay insulators shall be installed on all stays in accordance with the construction drawings.

#### **F. Field Modifications**

During the erection work at the field there may be necessity to modify galvanised steel hardware and may have to be drilled, reamed, filed or cut. Under such a condition the area of the steel exposed, after these modifications, shall be coated with a zinc-rich paint to protect the steel from corrosion.

### **3.0 CONDUCTOR**

#### **A. Materials**

XLPE covered conductors refer to an assembly of strands of hard drawn aluminium alloy for greater strength which are termed as All Aluminium Alloy Conductor (AAAC) Conductor.

#### **B. Sagging**

Conductors shall be sagged in accordance with the sag chart specified by these specifications.

The importance of careful sagging of conductors cannot be over emphasised. Conductors have definite characteristic that control their behaviour resulting from changes of temperature, wind speed and additional load due to ice or wet snow.

Conductors must not be sagged too tightly (less than specified sag) as unspecified extra tensions may result in failure of conductor structure.

Conductors sagged too loosely (more than specified sag) may contact adjacent conductors hardware or any structure. Excess sag can reduce clearance beneath the line with the ground to the point of danger.

#### **C. Sag Charts**

Unless otherwise noted, all sag charts are calculated on the basis of 35 kg/sqm wind pressure

Sag is always measured vertically, without wind, when conductors are being installed or re-sagged.

Unless otherwise specified by the Employer for a specific condition, initial or stringing sag shall be applied to the installation of all new unstressed conductor. The initial sag is always less than the final sag.

Sags for the various temperatures shall be furnished by the Engineer in a table form for spans not covered by the sag chart.

In order to ascertain the sag for a given stringing temperature, select the point corresponding to the proper temperature on the scale on the left-hand side of the sag chart. Lay a straight edge so that it passes through this point and the point of the centre scale representing the length of span to be sagged. The straight edge will then indicate the proper stringing sag on the right-hand scale. Interpolate if the temperature of span is not exactly the same as designated on the chart. The low voltage neutral conductor shall be sagged with the same sag as the low voltage phase conductor. If the low voltage conductor, as a group, has less design sag than the high voltage phase conductor installed above it, the low voltage conductor, as a group, shall be installed to the same sag as the high voltage conductors installed above.

#### **D. Stringing**

The dynamometers and similar apparatus shall be used for tensioning of conductor to obtain appropriate sagging of conductors.

For stringing of XLPE Covered (AAAC) Conductors of all sizes, stringing rollers or roller shall be used to support the conductor as it is pulled out and sagged. Stringing rollers shall be used regardless of size of aluminium conductors, bare or covered.

Stringing rollers shall be suspended at each insulator support position so that the conductor shall roll smoothly over the roller protecting conductor from any physical damage.

Stringing sheaves shall have a diameter at least 20 times the conductor diameter and so finished as to prevent damage of any kind to the conductor as it is pulled through the sheaves.

Conductor drum shall be located at a sufficient distance from the first structure to avoid excessive bending of the conductor over the sheaves and excessive downward loading on the cross-arms.

Attention shall be paid to the fact that all sag charts contained herein for AAAC conductors are calculated on the basis of non pre-stressed conductor. For this reason, at no time during the stringing or sagging operation, shall conductors of this type be pulled to sags which are less than those shown by the charts.

Special care shall be taken at all times to prevent the conductor from becoming kinked, twisted or abraded in any manner. Where it is necessary to drag conductors on the ground, the conductors shall be protected by covering all stones or other objects which might damage the conductor with boughs or trees or suitable pieces of lumber. These requirements are specially important when AAAC conductor is being handled on river crossing spans. Floats with rollers shall be used to prevent the conductor from dragging along the river bottom.

In stringing conductors across highways, the conductors shall be fully protected from passing vehicles by use of temporary guard structures.

#### **E. Damaged Conductor**

Damaged conductors shall be repaired by using a repair sleeve provided that no more than 2 strands of the outer aluminium layer are damaged and further provided that none of the sleeve core strands are damaged. For a conductor damaged in excess of the above conditions, the damaged section of the conductor shall be cut out and a tension splice installed.

When cutting out damaged section of conductor, no more than 1 tension splice shall be permitted in a span and no splice be made within 8 meters of an insulator attachment.

#### **F. Sag Error**

Sag error shall not exceed  $\pm 40$  mm from the sag defined by the sag chart.

### **G. Conductor Attachment**

Conductors shall be secured to pin insulators with pre-formed conductor ties or with tie wire. Insulator ties, except at jumper supports in structures, shall be made with pre-formed ties when available.

Conductors shall be connected to dead end assemblies with tension set.

### **H. Line Splices For Tensioning And Looping**

Cleaned and polished contact surfaces are necessary to make conductor splices so that it shall remain free from trouble. Great care shall be taken to completely clean the strands of aluminium conductor. The splicing sleeve must be centred over the conductor ends before compressing to make a splice of required strength.

The outer strands of aluminium shall be carefully cleaned with a wire brush to remove all foreign matter till the aluminium shines brightly. The cleaning applies to both new and old conductors. Splicing sleeves for aluminium conductor are supplied by the manufacturer pre-filled with inhibitor compound.

Splices in line conductors shall be so located that the end of the splicing sleeve is at least 30 cm from the end of a suspension or dead end clamp. Non-tension loops, such as between dead ends, shall be spliced with a connector when the conductor are of same metal and size.

### **I. Connectors**

1. Cleaned and polished contact surfaces are necessary to make electrical connections that will be free from trouble.
2. Tap connectors are supplied by manufacturers pre-filled with inhibitor compound. Excess inhibitor compound shall not to be removed but it shall be wiped over the connector as a moisture seal. Connectors shall not be covered or taped.
3. Compression connectors shall be located in such a manner that there shall be at least 30 cm of conductor between the end of the connector and the end of a dead end
4. Connectors shall be installed on non-tensioned portion of the conductor such as loops in preference to the conductor in the span.
5. Connectors installed on conductor shall be located in a span adjacent to the crossing rather than the crossing span when practicable.
6. Aluminium compression connectors, pre-filled with inhibitor compound, shall be compressed on the cleaned area of aluminium conductor. Where necessary, inhibitor compound shall be applied to the cleaned conductor and connector before assembly.
7. Aluminium compression connectors shall be used for connecting aluminium to aluminium conductors.

## **4.0 CONDUCTOR ACCESSORIES**

### **A. Pre-Formed Ties and Grips**

Taps for jumpers and services shall not be made over the legs of ties or dead end grips.

### **B. Pin Insulator Ties**

Pin insulator ties are of 2 types:

- a. **With single top grooves:** Single top ties may be used to turn line angles to 7 degrees where single insulators are permitted. Please refer material list CSG-29, 30 for specific applications.
- b. **With side grooves with specific size of ties for specific conductor in each tie style:** Specific usage is dictated by insulator pin loading and use of single insulators as specified in material list CSG-29, 30.

### **C. Preformed ties for Stay Wire**

Preformed ties for stay wire are furnished as per material list CSG-29, 30.

Preformed ties for stay wire are right hand lay. Preformed ties for stay wire may be removed and replaced up to 3 times, when initially installed, to permit adjustment of stay tension.

### **D. Application**

When applying ties or grips the manufacturer's identification tag and colour coding shall be checked to insure that the tie or grip is the right unit specified for application on the specific conductor or wire strand.

Preformed ties for stay wire are furnished with two crossover markings. When applying preformed ties on hardware, the grip shall be installed using the crossover point closest to the loop of the grip.

## **5.0 LINE CONSTRUCTION**

### **A. Arrangement of Conductor**

The standard position of 11 kV phase conductors on the cross-arm in the normal triangular configuration looking from the normal source of power supply shall be seen as:

Red (R) on top of the pole, Yellow (Y) on right hand end of the cross-arm and Blue (B) on left hand end of the cross arm.

### **B. Attachments To Poles**

Bolt holes are provided on poles for cross-arms, cross-arm braces and stay bolts.

### **C. Conductor Ties**

Pre-formed ties and grips shall be used for attaching conductors to structures when available.

If pre-formed materials are not available, the wire shall be soft conductor so that when made up, the tie wire will bind the conductor tightly. No tie wire shall be used for a second time.

Jumpers on structures shall always be made with tie wire as per Drawing No. CSG-29

Tie wire shall be of the same metal as that of the bare conductor to which the tie is applied.

### **D. Conductor Support**

The conductor supports on straight lines shall be carried on the top wire groove of the pin insulator. Conductors shall be attached to the side conductor groove of pin insulator on the outside of angles so that transverse conductor tension will tend to hold the conductor in the insulator groove.

Conductor ties shall not hold a conductor on the insulator when uplift exists. If uplift is found, it is required to consult with the Employer to determine remedial action to be taken.

### **E. Pole Wiring**

All taps or connections passing from one level to another on the pole shall, as far as possible, be vertical. Connections shall have sufficient length so that the line conductors are not moved from normal positions and normal movement is not restricted. Connections shall have at least 30 centimetres clearance from other conductors. Any connection carried from one side of the pole to the other side shall be supported on pin insulators.

## **6.0 INSTALLATION OF STAYS**

1. Where stays are installed on a line angle structure, line of stay shall bisect the outside line angle.
2. The span of stay extending between poles shall not be greater than 50 meter.
3. Anchor and anchor rods shall be set so that the axis of the rod and line of stay shall be straight. The portion of the anchor rod above the ground shall not be bent at an angle to connect a stay wire. If this occurs, anchor and anchor rod shall be reset. The anchor rod shall not be exposed for more than 15 centimetres above the ground after the anchor is set.
4. If gravel back fill is required to set anchor in soft or unstable soil, as per Drawing No. CSG-07, gravel back fill shall be designated as "Local Material".
5. If a stay is installed on a pole where low volt conductor is dead ended or double dead ended and extends past stay, a piece of plastic hose slit along the length shall be placed over the stay wire extending from the upper stay attachment to 200 mm below lowest low voltage conductor. After installation, the hose shall be wrapped with plastic tape and the hose shall be secured to the upper stay bolt with tie wire. Plastic hose shall be "Local Material".
6. The successful Bidder shall make preliminary survey of the work site to finalize the type of poles being used. The size / type and quantity of pole clamps may subject to variations as per fiend requirements.

## **7.0 TRANSFORMER STRUCTURES**

1. Distribution panel-board material and equipment ratings shall be determined by the kVA rating of the transformer and number of 400/230 volt out going distribution circuits. Please see Drawing No.CS11-TRN-01 to CS11-TRN-05 and associated material list for associated equipment ratings and quantities.
2. Where outgoing distribution circuits are installed, pole moment loading must be balanced by another outgoing distribution circuits in the opposite direction or by installation of stays.
3. Two separate rods shall be used to earth the transformer structure.
  - a. One for surge arresters and equipment
  - b. Another for the neutral of transformer low voltage winding

Each earth rod shall be driven at a minimum distance of 2 metres from the adjacent pole resulting in a minimum distance of 6 meters between the two ground rods.

4. Ground conductor lead shall be stranded steel wire.
6. 1/2" banding material shall be used to strap grounding conductors to pole(s) at one (1) meter intervals.
7. Compression connectors and PG clamp shall be used to make all electrical connections.
9. Conductor shall be terminated on main breaker and neutral bus with cable socket of proper size. If a sufficient number of connectors are not provided with the main breaker, the Contractor shall provide the remaining number required as local material.
10. Distribution Panel Board installation includes MCCB fitting and necessary connections with transformers and outgoing feeders

## **8. 12 kV XLPE ARMoured CABLE FOR 11 kV UNDERGROUND LINE**

### **1. 12 kV Underground Cable Installation works**

#### **1.1 Scope of works**

This specification covers the installation of 12 kV underground distribution networks with following details:

- i. 300 sq mm, 12 kV, 3 cores XLPE insulated armoured aluminium cable along the specified route complete with accessories HDPE, PPR pipes and cable joints.
- ii. Outdoor cable terminations for above cable complete with accessories including lightning arrestors, earthing and hardware fitting etc.

#### **1.2 Power Cable**

The power cable for the specified job shall be 12 kV, 3 cores Cross linked polyethylene (XLPE) insulated armoured aluminium cable of 300 sq mm.

#### **1.3 Cable Termination Kits**

The joints for underground power cables shall be complete with all necessary materials for joints. The Contractor shall submit the details of the joints for approval of the Employer. Cable joint shall be done as per the manufacturer's instruction.

#### **1.4 Cable Installation**

12 kV underground cables shall be laid at the places where the overhead line installation is difficult and the road crossing areas occurs. Contractor shall carry out site survey to finalize the locations and quantity of material for each location. The contractor shall submit the 1:200 scaled map showing route location of the 11 kV underground cable lines for prior approval from the Employer.

#### **1.5 Cable Terminations**

The Contractor shall prepare cable terminations for indoor and outdoor terminations. The termination works shall be made with utmost care by the skilled technicians. The termination works shall be according to the manufacturer's instructions.

The outdoor termination works shall include but not limited to following:

- Installation work complete with accessories
- Phase checking and connection to the existing overhead line.
- Dismantling of existing wires, terminal etc as required.

## 1.6 Cable Rising

In each outdoor cable termination, the cable shall be protected by PPR pipes of required dia at the rising portion on the pole. The protection pipe shall be fixed to the pole with suitable clamps from 0.3 meter below the ground to 2.5 meter above the ground. PPR Pipe shall be provided by the contractor.

## 2. Cable Trench Works

### 2.1 Scope of Works:

This specification covers but not limited to the construction of cable trench along the side of road or footpaths and cable trench across the asphalt road with HDPE pipe for power cable installation as per specification.

### 2.2 Cable Trench Excavation Works

The Contractor shall mark the cable route at site before excavation as per the survey map. In case of any change in the design route due to site condition, the modification works shall be done by the contractor without any extra cost to NEA. The contractor shall excavate cable trench of at least 90 cm. depths at the route along the road and 140 cm. depths at the crossing portion of the main road as per the drawing / instruction of the Employer.

All excavation works are to be kept dry and clean, in order that the work is not affected or interfered with water entering the excavations.

Water from excavation or dewatering shall be properly drained away from the site, so as not to inconvenience users of adjacent properties or sites.

The contractor shall be responsible for smooth and continuous work. The Contractor shall take necessary measures to minimize disturbance to traffic and pedestrian movement.

The XLPE power cable should be lying inner by using the HDPE pipe at the cable trench and PPR pipe is use for cable rising at the pole.

### 2.3 Backfilling Works

The contractor shall form a clean backfill free of sharp objects of minimum 15 cm thickness at the bottom of the cable trench, lay the cable on the bottom backfill layer, and provide a covering clean backfill free of sharp objects of minimum 20 cm thickness above top of the buried cable as shown in design. The remaining upper layer of cable trench space shall be filled using the excavated earth and gravel as show in Drawing no. CSG-34. Back filling shall be done in layer not exceeding 15 cm in thickness. Each layer shall be rammed and compacted well.

#### 2.4 Road Crossing

HDPE pipes of appropriate size (not less than 300 mm) shall be used for road crossing. The pipe shall be laid in an angle to avoid sharp bends at the point of entry and exit of the cable. The pipe shall be provided by the contractor.

#### 2.5 Surplus soil

Surplus soil shall be disposed/removed off immediately in the approved spoil bank area or shall be used for embankment and backfilling upon approval of the Client. Such disposal shall also be subject to the local regulation and the Employer's approval.

#### 2.6 Earthing

Earthing rod as specified shall be driven into the ground near the pole. 6 SWG G.I. wire shall connect the earthing rod, lightning arrestor and armour of the cable.

#### 2.7 Lightning Arrestor

9kV Lightning Arrestor shall be fixed in the suitable cross arm at each cable connection with overhead line and ground through Earth Wire together with sheath earth.

#### 2.8 Material Handling

The Contractor shall use appropriate crane for safe unloading of cable drum. Rollers of appropriate size shall be used. The Contractor shall provide sufficient number of roller for the cable pulling works. Cable drum shall be mounted on cable jacks and shall be rolled off gently avoiding kinks and twist

## **9. ABC CABLE**

### **FOR 0.4 kV OVERHEAD LINE**

#### **A. GENERAL**

1. The insulated neutral messenger supported Aerial Bundle Conductor consists of five XLPE insulated cores (3 phases, one neutral and one street lighting) of hard- drawn stranded aluminium conductors which are laid up together.
2. Special care should be taken when handling the cable drums, and the unwinding, pulling, stringing and clamping the cables.
3. Precautions should be taken to prevent the bundle from dragging over the ground, ensure adequate protection when crossing fences or any other obstacles to avoid damage to the cable insulation.

#### **B. POLE PREPARATION**

1. Hardware can be fitted to poles before or after the poles are set up.
2. Hardware can be fixed to poles by means of:  
  
Pigtail hot dipped galvanised bolts, nuts and washers  
or  
hook hot dipped galvanised bolts, nuts and washers

#### **I PROCEDURE FOR SETTING UP THE LINE**

1. Before setting up the lines, necessary precautions must be taken such as the suitable staying of line poles to avoid the overstraining of the supports and hardware, which are not designed to resist to dead end line stresses.
2. Suspension fittings should be used where the line angle is less than  $60^{\circ}$ . When the line angle exceeds this value double strain assemblies must be used.
3. Hardware should be fitted to either side of the poles to accommodate angles in the line. In the event of an accident this will allow the cable to swing free and avoid damage.
4. When ABC lines are installed on a hill a double dead end assembly is recommended instead of a suspension bracket on the peak of the hill, as the weight of the ABC will load the bracket excessively. On a gradient the cable is pulled from the higher to the lower point.
5. Following the line adjustment, the strained bundles sections will be kept on stringing blocks during a minimum period of 24 hours before clamping the line and angle suspensions.

**C. RUNNING OUT PREPARATION****I. CABLE LAYING**

1. The drum is positioned 8-10 m behind the support, used for final adjustment. It is slightly set off (1m) from the pole on the side of the first stringing block, to prevent any friction of the twisted cable against the pole.
2. In the case of strong gradient the drum is positioned at the higher point (extremity) on a drum carrier equipped with mechanical breaking device to regulate the running out the cable.
3. The cable drum (drum carrier) should be positioned to allow the cable to roll off the top of the cable drum and 8-10 metres from the first pole. (such distance is equal to the length of the pole over the ground)
4. The cable must not drag on the ground during laying operations.
5. The rotation of the cable drum will be controlled by the operator and if necessary be regulated with a breaking system.
6. Passing the conductors through the stringing blocks and pulling the bundle with a pulling grip performs the pulling
7. Stringing blocks (wide grooved pulley) shall be hung on poles, by means of a nylon or rope sling in chocker fashion or a special device developed for such application consisting of a pulley and a saddle which includes a bracket and a lashing device.
8. The pulled extremities must be tied with cable ties to avoid untwisting of the bundle. Pulleys are fitted on supports, just below the pigtail/hook bolts in such a manner that the bundle is near the level of the suspension clamp. This ensures:
  - easy placement of the bundle in the suspension clamps.
  - minimum untensioning during the installation of the strain clamps.
9. Stringing blocks or pulleys must not be suspended from the pigtail/hook bolts. These are not designed to support the loads exerted during the pulling.
10. The pulling of the bundle should be by mechanical means. However, it can be done manually in the case of line section not exceeding 100 metres with maximum spans of 50 metres.
11. Precautions should be taken to avoid damage to the cable insulation.

## **II LINK BETWEEN THE PULLING ROPE AND THE BUNDLE**

1. A pulling rope is threaded through all the pulleys on the route. This rope should be
  - ø10mm Polyester rope, for a manual pulling
  - ø12mm Polyamide rope, in case of mechanical pulling
2. Attach the pulling rope to the ABC by means of a ball bearing swivel and pulling socks set.  
This set includes:
  - a galvanised steel sock fixed in permanence to the rope
  - a galvanised steel sock is slipped over the bundle, selected according to bundle diameter
  - a swivel is fitted between the two galvanised steel socks.
3. Prepare adequate protection where cables cross fences of any other structures on route
4. The foreman verifies that the rope slide normally and that ABC does not suffer any damage by sharp objects.
5. The people in charge of the drum carrier regulate the breaking according to the sag chart instructions given to him.
6. The pulling action should be slow and continuous avoiding unnecessary jerking.

## **III REALISATION OF THE FIRST TERMINAL POLE**

1. No lineman has to remain on poles.
2. At the last pole of the run, the bundle is clamped with a come-along and tension is provided by a cable/chain hoist linked to the pole by nylon or rope sling.
3. The recommended tension is obtained by a dynamometer and sagging of conductors shall be made according to the sag chart.
4. When the required tension/sag has been reached, locate with an adhesive tape where the strain clamp shall be positioned and then proceed to fit the strain clamp on the bundle. Exert an extra load on the bundle in order to facilitate the installation of the strain clamp to the pigtail/ hook bolt.
5. Fit a cable tie in front and behind the clamp to keep all conductors together.
6. Release the apparatus and remove the stringing block.
7. The dead end assembly consists of:
  - One pigtail or hook bolt
  - One dead end clamp for self supporting bundle
  - Two cable ties made of polyamide for clamping bundled conductors

#### **IV REALISATION OF THE FIRST LINE SECTION**

1. The tensioning of the first line section shall be made at the first double strain point. For such procedure a chain or cable hoist equipped with a reel is needed.
2. The loads being more or less equilibrated, no staying is required.
3. The line adjustment for the fixing of the dead end clamp on bundle is obtained as follows:
  - 3.1 Proceed simultaneously on the two tensioning devices (one at the termination pole and the other at the double strain assembly) in order to obtain the adjustment of the first line section and the slack bridge needed for the double strain assembly.
  - 3.2 Install the strain clamps by exerting a supplementary traction in order to facilitate the fixing of the clamps on the bolts.
  - 3.3 Release the loading device at the double strain point.
  - 3.4 Remove the equipment (Cable hoist Pulley)
  - 3.5 The others line section are realised in the same manner
  - 3.6 The last line section is realised as the first terminal pole

#### **V INTERMEDIATE POLES**

1. Lift the cable from the pulley and fit the bundle into the suspension clamp.
2. Close the suspension clamp and fit a cable tie on the ABC either side of the suspension clamp
3. The suspension assembly consists of:
  - One pigtail or hook bolt
  - One suspension clamp for self supporting bundle
  - Two cable ties

#### **VI CABLE JOINTS**

1. Using pre-insulated ferrules should join the cables.
2. Lay two cables to be joined in juxtaposition in order to stagger the joints and prepare to joint phase to phase etc.
3. Strip the insulation according to the length (strip length) indicated on the ferrules. Take particular care not to damage the aluminium stands.

4. Pass the conductor through the seal at the end of the ferrule and onto the center barrier. The seal should be securely seated on the insulation of the conductor.
5. Crimp the ferrule with standard compression die indicated on the ferrule, starting at the center and progressing to the outside. Pre-insulated ferrules are also used for repairing accidental damage to conductors.

## **VII LINESMEN TOOLS**

Necessary tools required for ABC Cable stringing:

- unwinding machine or similar equipment provided with drum braking system
- a ground hoist or winch, strong enough to give an efficient suppleness.
- traction rope having a length and a mechanical resistance sufficient to allow pulling and stringing operations upto ten spans of ABC
- stringing blocks (one per support) 10 spans -11 supports
- hydraulic compression tool (performance motorized since faster more easy to use in remote areas)
- Pulling grip for ABC Cables
- Pulling grips for bundle

## **10. INSTALLATION CRITERIA**

### **GENERAL INSTRUCTION**

1. The line alignment should be as straight as possible to minimise requirements for stays.
2. The basic span shall be maintained within the following limits:-
  - a) For 11 kV: 50 m to 70 m
  - b) For 400 V and 230 V: 40 m to 55 m
3. The entire construction works shall be performed as per the construction units specified. Whenever the construction unit does not cover any specific activity, the Contractor and the Project shall mutually settle the cost as per the man-hour involvement for the same and according to the labour rate quoted by the Contractor in his Bid.
4. Detailed schedules of material to be used are provided in each structure drawing of the construction standards. It shall be the responsibility of the Contractor to judge the appropriateness of the listed material according to the site conditions. If there is any need for addition/reduction or deviation from the listed material size/quantity, the Contractor shall ask the Project for the approval of the same.
5. All types of line clearances shall be maintained as per the construction standards provided to the Contractor. Deviations from the standards may be allowed only for unique or special conditions.
6. Safety rules of the NEA shall be strictly observed at all times by the Project, Contractor and their personnel. Special care shall be taken to maintain the optimum conductor sag to provide adequate safety to the construction and the property or people.
7. All fastenings (e.g. preformed ties, nut bolts, stays etc.) shall be so installed that the constructed line components shall not fail to remain within the safety margin while maximum working load is applied.
8. If the Contractor requires clarification of any construction standard or unit or he feels any doubt in his interpretation of construction activities he should clarify the points with the Project in writing and the decision thus made shall be valid for further work.
9. HV Insulators: The Contractor shall use HV pin insulators in the alignment of the line where the break angle does not exceed the limits provided hereafter.

<b>S.No.</b>	<b>Conductor Size in sq. mm.</b>	<b>Minimum Break Angle in Degrees</b>
1	120 (XLPE Covered Conductor)	7

In the case where the break angle exceeds the above values the Contractor shall make dead-end at the angle structure and use disc insulator fittings.

10. Stays:- The Contractor, in general case, shall install at least one stay for the supports in the following cases:
  1. Dead end structure
  2. Tee-off (Tap) structure
11. Transformer mounting:- Each transformer (except single phase pole mounted) shall be so mounted on the plate-form that the centre of the transformer is in the middle of the plate-form. Deviations are not permitted from this rule.



**Section VI-E**

**SPECIAL REQUIREMENTS FOR EXECUTION OF  
WORKS**

**SECTION VI-E**  
**SPECIAL REQUIREMENTS FOR EXECUTION OF WORKS**

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## **1. Site Office Management**

- 1.1 The contractor and / or sub contractors as proposed by the bidder as per GCC shall establish and maintain throughout the period of the performance of the contract a site office to serve as a base for all the operations necessary to perform the works and shall maintain adequate store facilities for storing materials and equipment issued by the employer. In case the above-mentioned facilities and establishments are not found satisfactory during the site verification, the employer shall have right to instruct the contractor for rectification of the same.
- 1.2 Prior to the beginning of construction works the contractor at his own cost shall establish a demonstration and training installation of 11/0.4 kV structures as listed in construction standards of tender document. The installation shall include at least 3 spans of AAAC conductor and ABC cable of each size to illustrate the type of materials used for tangent, angle and dead end construction for 11/0.4 kV line. Such structures need not be spaced more than 10 meters apart. The intent of establishing such arrangement shall be to provide visible examples of the application of the various materials to be used and to provide training and testing facility for the contractor's line construction personnel.

## **2. Contractor's key personnel and workforce**

- 2.1 The contractor shall have experienced and qualified administrative, accounting and store keeping staffs capable to undertake respective jobs. An office manager with adequate qualification and experience to run such establishment efficiently must head the site office. The contractor shall employ only experienced, competent and skilled office staff as required in the tender document.
- 2.2 The line construction and supervisory staff of the contractor shall be examined by the employer to ensure their capability to perform proper quality of work as per Evaluation Criteria (Section 3) clause no. 2.5 before commencement of the work.
- 2.3 The site and field staff as approved by the employer shall be made available for the entire construction period of the project. All the staff and workforce of the contractor shall be issued identity cards jointly certified by the contractor and the employer. Replacement of any such staff or site personnel must not be made without prior permission of the employer.
- 2.4 The contractor is required to pay salary and wages of his staff and workforce at an interval not exceeding a month. The rate of wages payable to the labours shall not be less than as prescribed by the labour law of Nepal.

## **3. Tools and Equipment**

- 3.1 The Contractor shall have owned, leased or hired tools and equipment for successful execution of the work. Prior to beginning of the work the contractor shall show these items in his possession. In case of the heavy tools equipment and vehicles the contractor

is required to submit the source of these items with credible documents such as contract papers conforming their availability at the time of the execution of the works.

- 3.2 The employer shall examine to verify the availability of all such tools and equipment before commencement of the work. The contractor shall be allowed to start his work only after verification of such tools and equipment in satisfaction of the employer. No tools and equipment shall be provided by employer.

The contractor shall have following tools and equipment for the execution of the contract:

<b>SN</b>	<b>Description of Tools and Equipment</b>	<b>Unit</b>	<b>Quantity</b>
1	Crane Truck (Minimum 3 Ton lifting capacity)	Nos.	1
2	General Purpose Truck (Minimum 10 Ton capacity)	Nos.	1
3	Max or Ratchet Puller suitable for HV/LV Cable Tensioning	Nos.	5
4	Come along Clamp suitable for HV/LV Cable Tensioning	No.	5
5	Crimping Device for jointing Cables	Nos.	2

#### **4. Approval of Drawings**

- 4.1 The contractor shall update and revise all plan and profile drawings provided to him by the employer after performing check survey of each of the segment of the scheme.
- 4.2 The contractor must get approval from the employer in writing before he starts execution of construction of any of the segment of work. If the contractor executes any work without the employer's prior approval, he may be asked to revise the same without paying any compensation to him.

#### **5. Extra Work**

- 5.1 Extra work and goods supply shall be performed in accordance with written directives as issued by the Project to the Contractor.
- 5.2 Extra work or goods supply for which there are applicable unit prices will be paid for at such unit prices.
- 5.3 Where there are no applicable contract unit prices, the price to be paid by the Project to the Contractor for extra works / goods supply shall be fixed through negotiation between Employer and the Contractor based on:

- the GoN norms and respective district rate approved by the District Rate Fixation Committee in case of extra works to be performed
- the prevailing market rate of the goods, in case of extra goods to be supplied.

In no case, such price shall exceed Project's cost estimates for the item.

- 5.4 Nothing in this Clause shall excuse the Contractor from proceeding with the extra work as directed in writing by the Project.
- 5.5 Any variation in the quantities of unit price construction units, within the ranges stated in the Special Conditions of Contract, Clause 1.3, from nominal bid quantities of such unit price construction units shall not be construed as Extra Work.

## **6. Materials**

- 6.1 Major construction materials (Distribution Transformers, switches, insulators, poles, conductors, cables etc.), for installation of the Works shall be provided to the Contractor by the Project.
- 6.2 All materials and equipment of the Project shall be located at the Project's or such other areas where they are being stored. During issue and handling over of these materials it shall be the Contractor's responsibility to load all of them and provide all necessary lifting and handling equipment, labour and suitable transport as required to transport the various items of materials and equipment to the Contractor's site of storage and operations.
- 6.3 The listing of materials shall show the limiting allowance for breakage and scrap and material unit prices, which may be applied to the contractor's accountability to the Project for all materials and equipment issued by the Project. Allowances for such materials shall be as under:
- |                        |       |
|------------------------|-------|
| - HV Covered Conductor | 0.5 % |
| - ABC Cables           | 0.5 % |
- 6.4 Accountability for all materials and equipment issued by the project shall be based on the material lists associated with the various construction drawings contained in the Construction Standards and the allowances referenced in clause 3 above. At the time of final material accounting, any deficit in the Contractor's material account shall be charged to the Contractor at the unit price rates enlisted by the project during handing over of the materials to the Contractor.
- 6.5 If the Contractor fails to account for all materials and equipment issued by the Project as set forth in clause 4 above, the Contractor shall be charged for the missing materials or equipment. The Project shall have the right to withhold money due or to become due to the Contractor, as reimbursement for the deficit in the Contractor's material.
- 6.6 Prior to the rehabilitation work, representative of the NEA's local branch office the Site Engineer and the contractor shall jointly inspect the materials to be dismantled and list down such materials. It shall be the contractor's responsibility to pack those goods

appropriately, transport them to the nearest NEA store and get receipt. Such receipts shall be enclosed with the subsequent invoices claimed by the contractor.

## **7. Local Materials**

- 7.1 Certain minor items of materials, including civil materials, required by the Construction Standards are designated Local Materials in the Standards and shall be furnished and installed by the Contractor as part of the completed unit of construction.
- 7.2 The contractor shall include the cost of such items of materials in his quoted construction unit prices and no other payments for such materials shall be made to the contractor.
- 7.3 The project, may, at its option, require the project's approval of any or all Local Materials prior to procurement of such items by the Contractor.
- 7.4 It shall be the Contractor's responsibility to determine his requirements for any items of Local Material in a timely manner and make procurement accordingly. No delays shall be allowed, and no exceptions made to the required use of Local Materials due to the unavailability of such materials.

## **8. Construction Time Schedule**

- 8.1 Before the commencement of construction works the contractor shall be required to submit a detail construction time schedule showing details of each event of construction of different components of works so as to complete the whole work within the time frame as per the requirement of the contract. The contractor's proposal shall be examined by the employer to ensure his ability to perform the work in time and approval shall be given with any modification, if necessary, in satisfaction of the employer.
- 8.2 If the contractor fails to execute the any component of work within the period specified in the construction schedule, the employer shall have right to warn the contractor to make up for such delay in time. In case the contractor fails to overcome delay in different components of the works instead of repeated reminders by the employer, he shall be made fully responsible for any delay in final time schedule and no consideration shall be made for any extension of construction period for the whole work.

## **9. Measurement of work and material**

- 9.1 The contractor after completion of work of any segment of work as per approved drawing of the project shall submit detail work measurement in structure data sheet (SDS) as per the format Sheet-1 in this section of the tender document.
- 9.2 Measurement of the work performed by the contractor shall be jointly checked by the contractor and the staff deputed by the employer. In case of any discrepancy or dissatisfaction of employer staff the contractor shall be notified for making corrections for the same and the contractor shall have to submit his revised measurement schedule.
- 9.3 The contractor shall be issued materials based upon the requirements to perform his work conveniently. The contractor is required to submit detail of materials measurement in material data sheet (MDS) for each of the segment as per the prescribed format Sheet-3 in this section of the tender document. The contractor shall assess quantity of each and every item of materials from the material data sheet. Small items such as binding wire, nails, binding tape etc. could be assessed on flat basis.
- 9.4 While submitting running bill the contractor must submit details of quantity of materials issued to him, quantity consumed as assessed from the material measurement sheet and quantity in his possession. Materials issued, used and in contractor's possession must be reconciled as per the prescribed format Sheet-3 in this section of the tender document. The materials in possession of the contractor shall be the opening material balance for the next running bill. The contractor shall also submit copies of store vouchers showing details of materials issued to him. Statement of materials submitted shall be checked and certified by the employer before payment of each of the running bill.

## **10. Workmanship and quality of work**

- 10.1 The contractor shall be attentive to maintain workmanship and quality of work while performing the work and shall obey to all the instructions of the field staff of the project time to time in this regard.
- 10.2 Special items such as concrete works, cable jointing works and transformer installation works etc. must be performed in presence of the project field staff. In case of the concrete works the project staff shall assess quantity of cement and steel to be used for each of the job and this must be followed for performing the job. Sand and aggregate must be supplied as per the standard specification of the tender document. The project field staff shall check quality of such materials and the contractor shall use the same after his approval. Curing of concrete works must be carried as per standard practice. The field staff shall have right to ask the contractor to repeat concrete works in case of his failure to execute the job as above or in his absence.
- 10.3 Each and every item of the standard data sheet (SDS) shall also be checked by the project staff for the satisfaction of quality of workmanship as per the prescribed specification of the tender document. In case of failure of the contractor to execute any item of the work as per proper workmanship or quality, the project shall have right to ask the contractor to revise or remedy such work at the cost of the contractor.

**11. Commissioning of work**

- 11.1 After completion of entire work of any village or load centre, the project after necessary tests shall arrange to electrically charge the same. In case of successful operation in satisfaction to the project the contractor shall be issued a provisional certificate starting from the date of such commissioning.
- 11.2 The Project shall be authorized to change such date of commissioning in case of failure of the line due to any defect in the quality of construction.
- 11.3 Final acceptance of work shall be issued only after completion and satisfactory commissioning of whole work of the contract.

**NEPAL ELECTRICITY AUTHORITY  
DISTRIBUTION SYSTEM REINFORCEMENT AND LOSS REDUCTION PROJECT**

**MATERIAL DATA SHEET (MDS)**

**(SUBMITTED WITH R. B. No.....)**

Tender No:-  
Tender Details:-  
Name of Contractor:-  
Running Bill No:-

Site Office:-  
Scheme:-  
Load Centre:-  
Running Bill Date:-

SDS No:-  
Current Issue Date:-

C.U.	Description	Unit	Quantity	Material Used Qty. as per current bill
1	2	3	4	5

Submitted by:-

Checked by:-

Approved by:-

Contractor's Signature:-

Site Supervisor:-

Site In charge/Engineer:-

Contractor's Seal:

**NEPAL ELECTRICITY AUTHORITY**  
**DISTRIBUTION SYSTEM REINFORCEMENT AND LOSS REDUCTION PROJECT**

**MATERIAL RECONCELLATION REPORT (MRR)**  
**(SUBMITTED WITH R. B. No.....)**

Tender No:-

Site Office:-

Tender Details:-

Scheme:-

Name of Contractor:-

Load Centre:-

SDS No:-

Running Bill No:-

Running Bill Date:-

Current Issue Date:-

Item No.	Description	Unit	As per Contract		Issued to Contractor			Material Used			Balance with Contractor					Balance to be issued as per contract
			Qty	Amount	Upto previous issue	Current issue	Total	Upto previous bills	Current bill	Total	Open Balance	Current issue	Material used as per current bill	Closing balance	Amount of closing balance	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17

Contractor's Signature:-

Site Supervisor:-

Store Keeper:-

Site In charge/Engineer:-

**NEPAL ELECTRICITY AUTHORITY**  
**DISTRIBUTION SYSTEM REINFORCEMENT AND LOSS REDUCTION PROJECT**

## Structure Data Sheet

District:  
VDC:  
Scheme:

Tender No:  
Tender Detail:  
Name of Contractor:

[illegible]



**Section VI-F**

**CONTRACT EXECUTION SCHEDULE**

## SCHEDULE -1

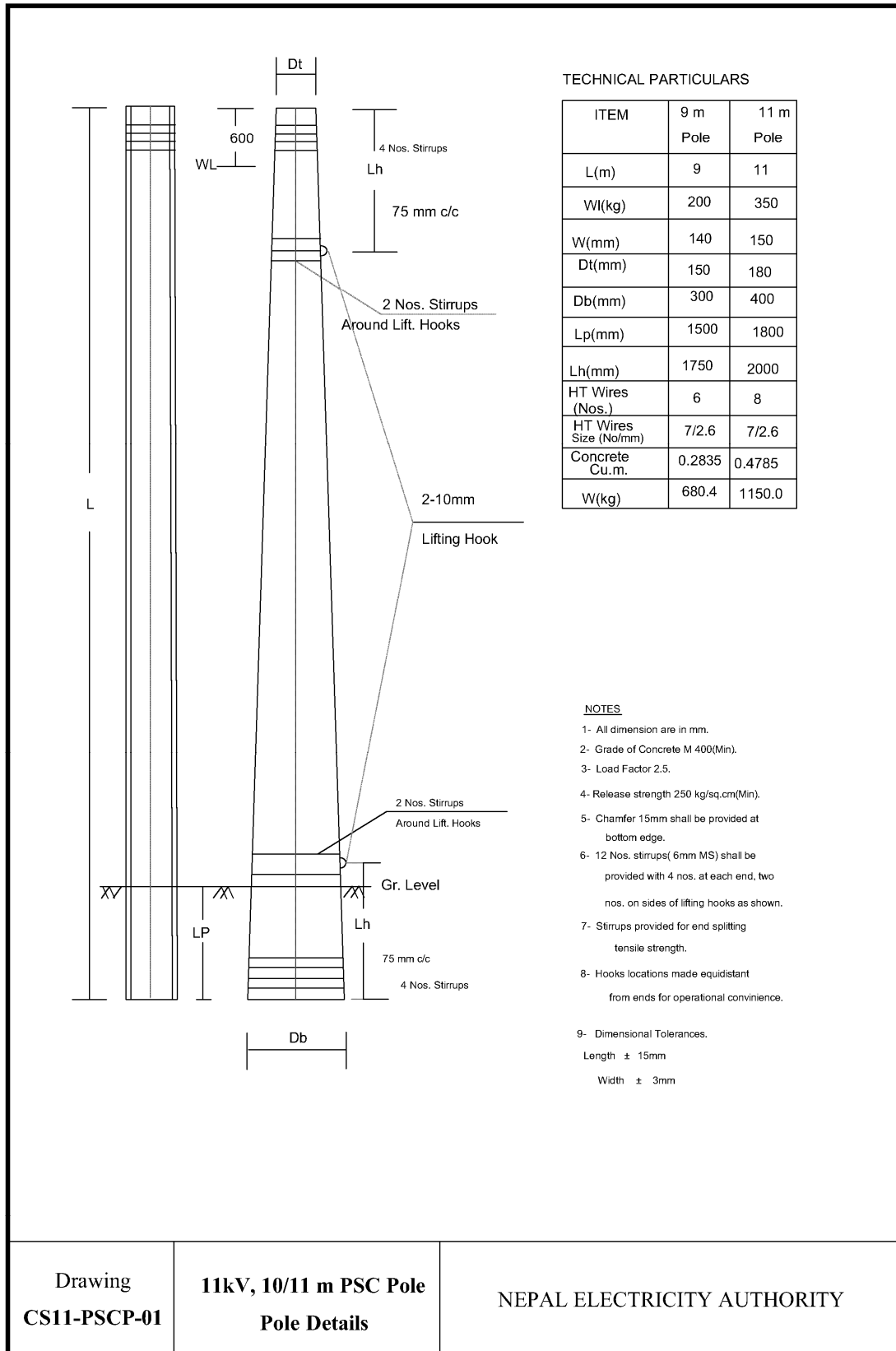
### Work Execution Schedule

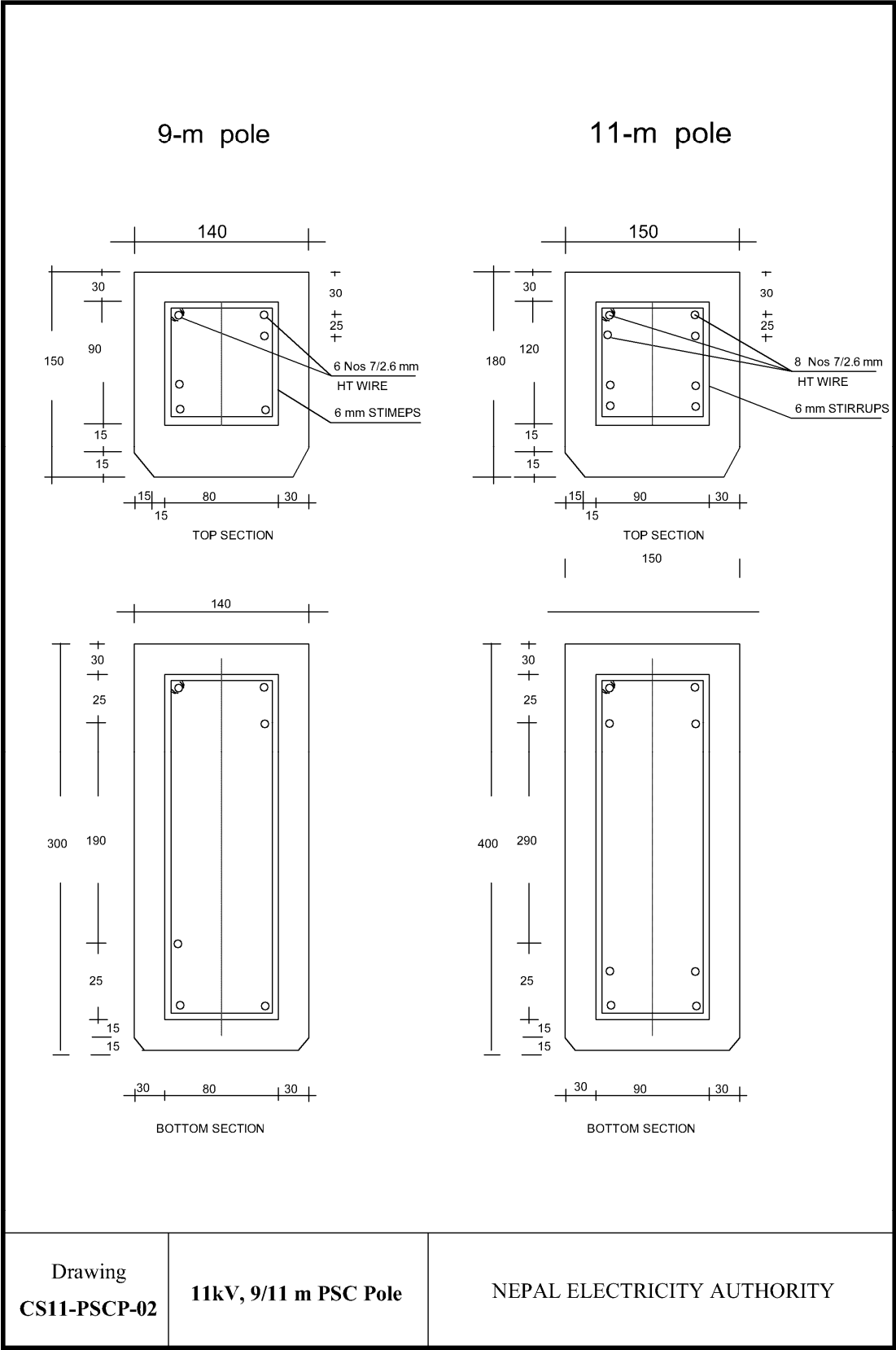
The Works shall be completed in 540 days from the date of Effective Date in the following manner.

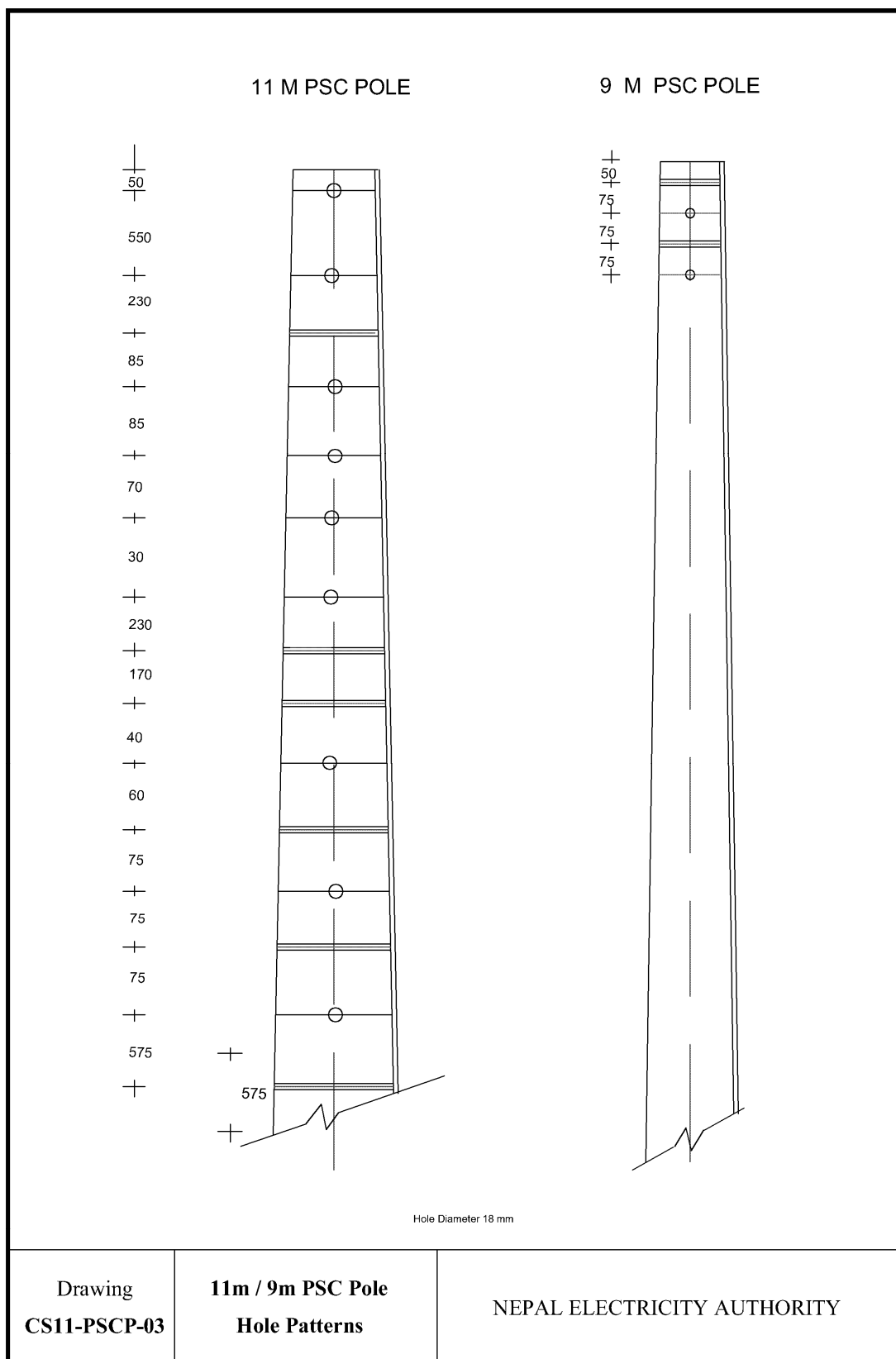
Description of works	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Contract Agreement	■																	
Work Team mobilization		■																
Pre-construction survey, data sheet submission and material pro		■	■	■	■	■	■											
Construction works				■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Preparation of as built drawings & SDS															■	■	■	■
Testing and commissioning and handover												■	■	■	■	■	■	■

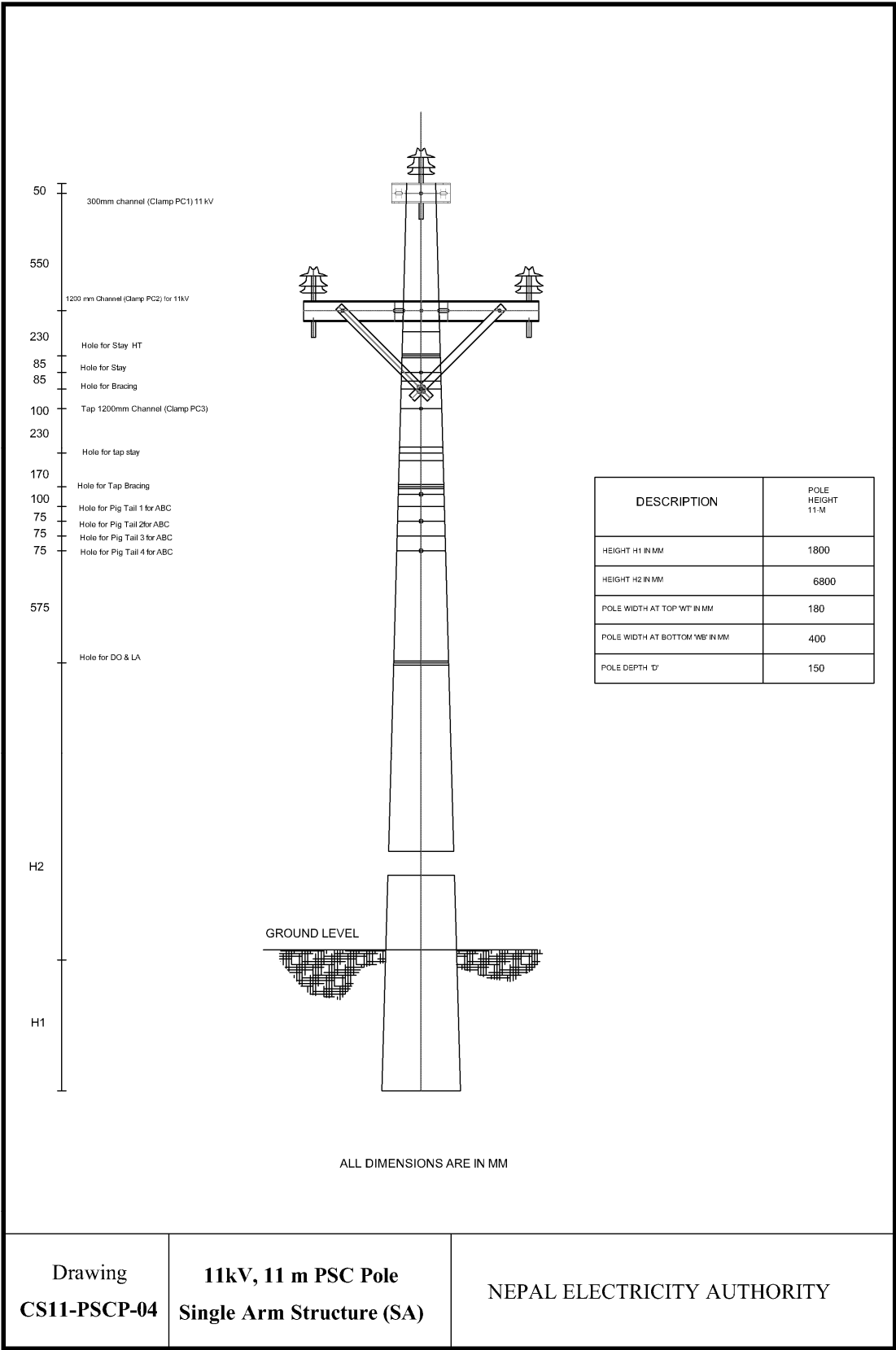
**Section VI-G**

**CONSTRUCTION STRANDARD DRAWINGS AND  
MATERIAL LISTS**





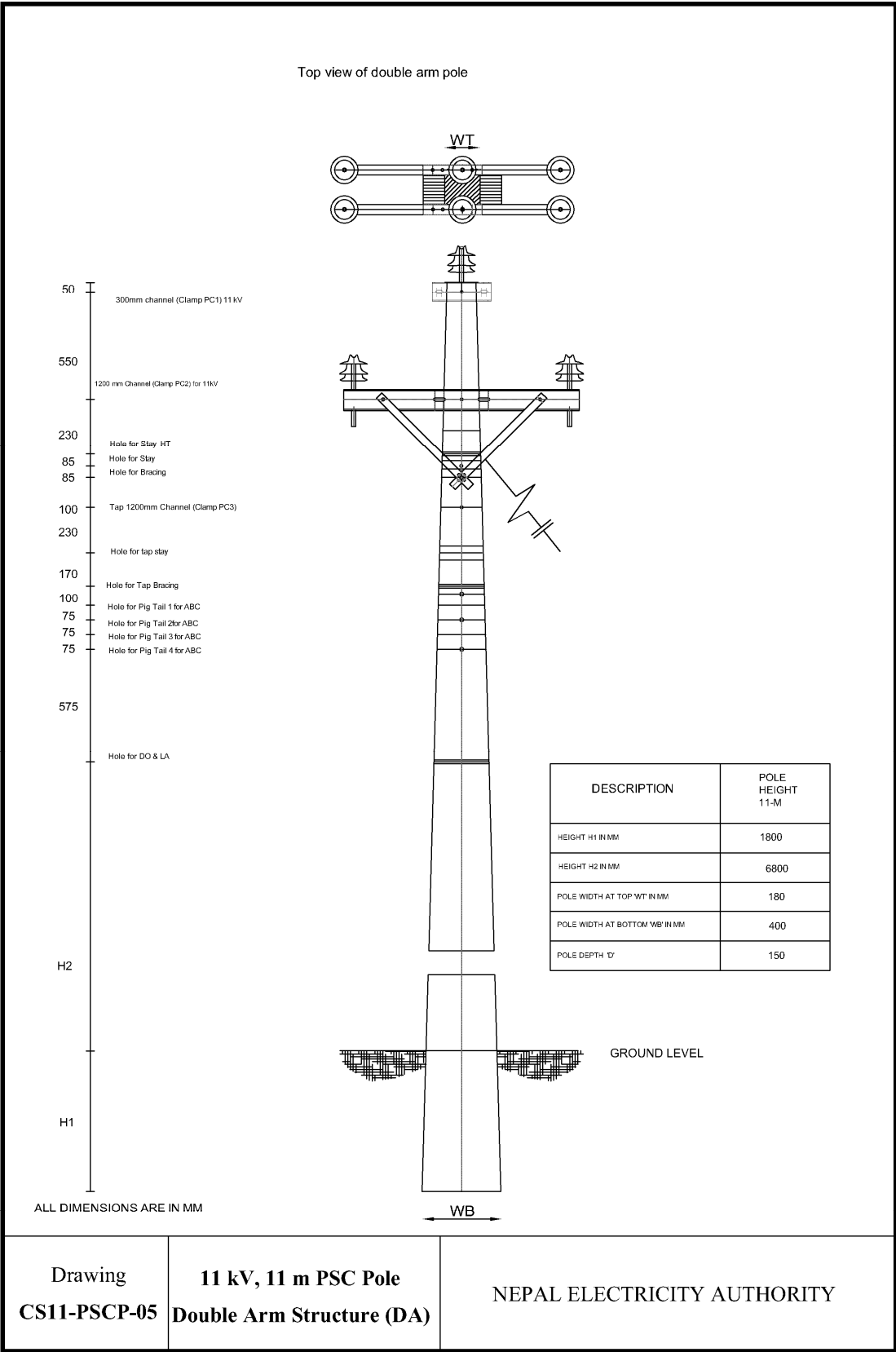




S.No.	QTY.	UNIT	MATERIAL
1	3	NOS	PIN INSULATOR WITH PIN AND NUTS/WASHER
2	1	NOS	STEEL CROSSARM CHANNEL ( 50x100x300 ) mm.
3	1	NOS	POLE CLAMP WITH NUTS, BOLTS AND WASHERS (PC1)
4	1	NOS	STEEL CROSSARM CHANNEL ( 50x100x1200 ) mm.
5	1	NOS	POLE CLAMP WITH NUTS, BOLTS AND WASHERS (PC2)
6	2	NOS	FLAT CROSSARM BRACE (40 X 6 X 660) mm
7	1	LOT	BOLTS WITH SUITABLE NUTS AND WASHERS
8	3	NOS	PREFORMED WIRE (TOP TIE)
9	1	NOS	PSC POLE 11 M

**CONSTRUCTION STANDARDS**  
**11 kV SINGLE ARM STRUCTURE (SA)**  
**PSC POLE**

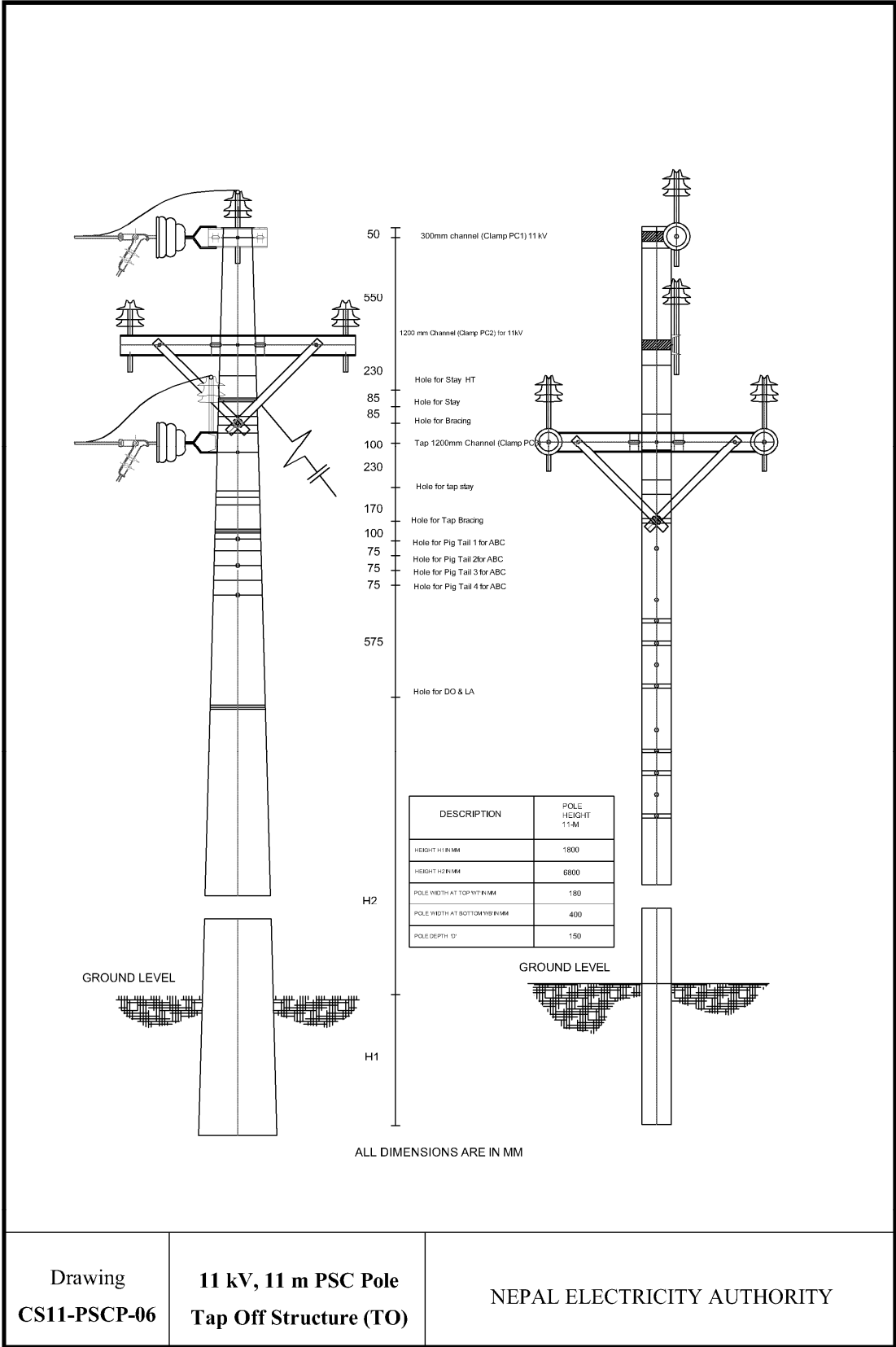
**NEPAL ELECTRICITY AUTHORITY**



S.No.	QTY.	UNIT	MATERIAL
1	6	NOS	PIN INSULATOR WITH PIN AND NUTS/WASHER
2	2	NOS	STEEL CROSSARM CHANNEL ( 50x100x300 ) mm.
3	2	NOS	STEEL CROSSARM CHANNEL ( 50x100x1200 ) mm.
4	4	NOS	FLAT CROSSARM BRACE (40 X 6 X 660) mm
5	1	LOT	BOLTS WITH SUITABLE NUTS AND WASHERS
6	6	NOS	PREFORMED WIRE (DOUBLE SIDE TIES)
7	1	NOS	PSC POLE - 11 M

**CONSTRUCTION STANDARDS  
11 kV DOUBLE ARM STRUCTURE (DA)  
PSC POLE**

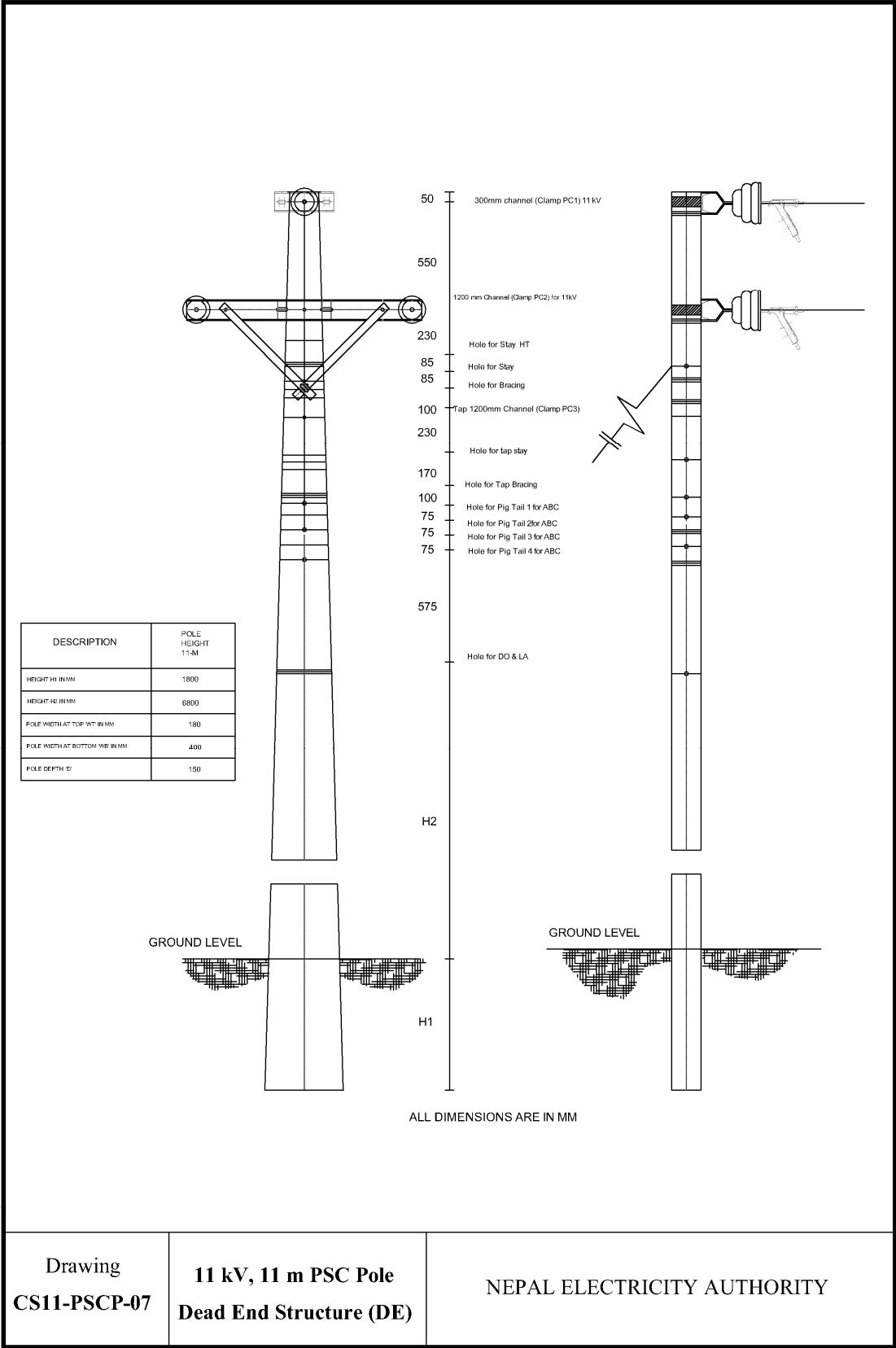
**NEPAL ELECTRICITY AUTHORITY**



S.No.	QTY.	UNIT	MATERIAL
1	5	NOS	PIN INSULATOR WITH PIN AND NUTS/WASHER
2	3	SET	DISC INSULATOR WITH HARDWARE
3	3	NOS	DEAD END CLAMPS
4	1	NOS	STEEL CROSSARM CHANNEL ( 50x100x300 ) mm.
5	1	NOS	POLE CLAMP WITH NUTS, BOLTS AND WASHERS (PC1)
6	2	NOS	STEEL CROSSARM CHANNEL ( 50x100x1200 ) mm.
7	1	NOS	POLE CLAMP WITH NUTS, BOLTS AND WASHERS (PC3)
8	4	NOS	FLAT CROSSARM BRACE (40 X 6 X 660) mm
9	1	LOT	BOLTS WITH SUITABLE NUTS AND WASHERS
10	5	NOS	PREFORMED WIRE (TOP TIE)
11	3	NOS	INSULATED PIERCING CONNECTORS
12	1	SET	HT STAY (TYPE AS REQUIRED)
13	1	NOS	PSC POLE - 11 M

**CONSTRUCTION STANDARDS  
11 kV TAP OFF STRUCTURE (TO)  
PSC POLE**

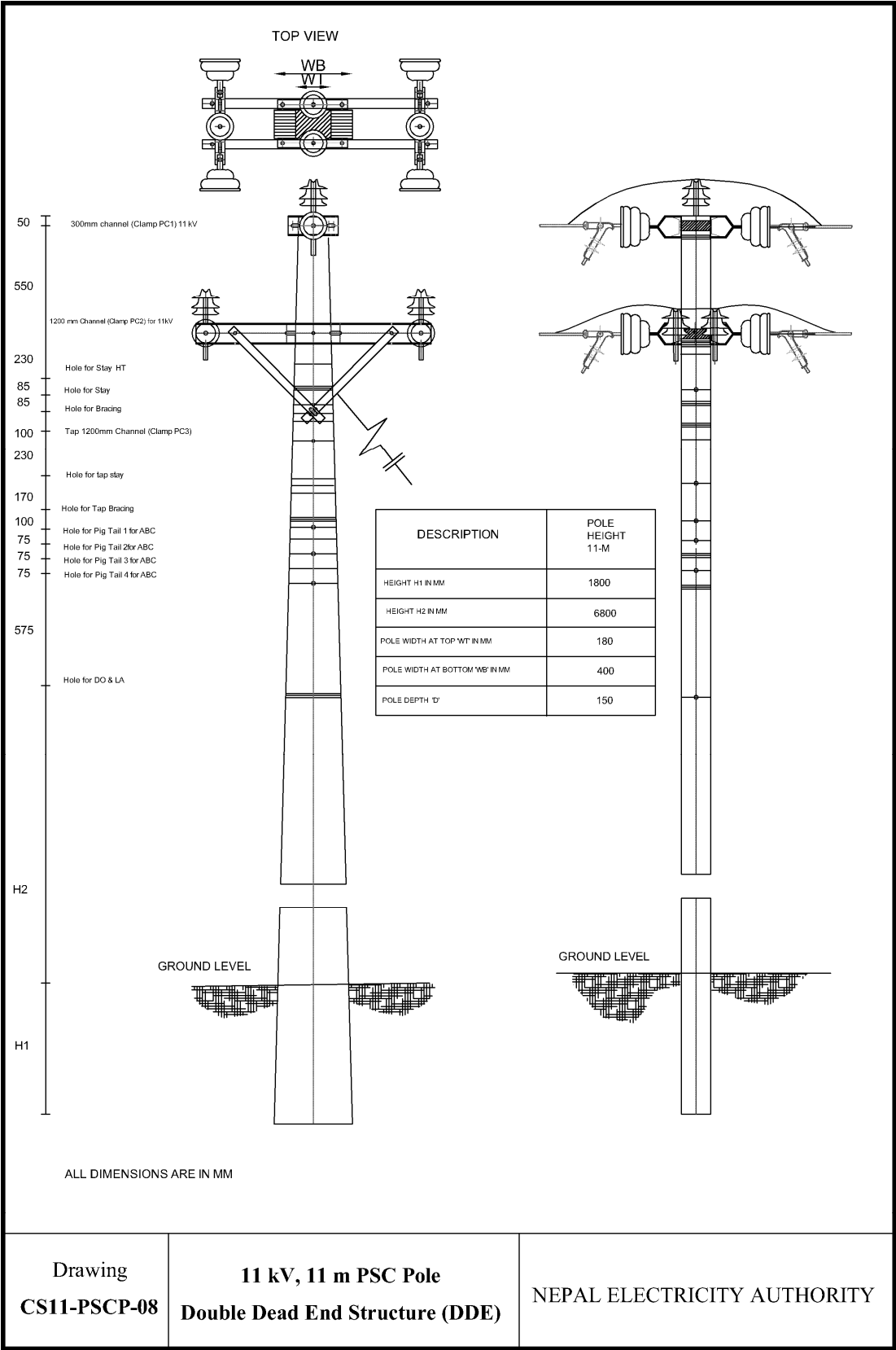
**NEPAL ELECTRICITY AUTHORITY**



S.No.	QTY.	UNIT	MATERIAL
1	3	NOS	DISC INSULATOR WITH HARDWARE
2	3	NOS	DEAD END CLAMPS
3	1	NOS	STEEL CROSSARM CHANNEL ( 50x100x300 ) mm.
4	1	NOS	POLE CLAMP WITH NUTS, BOLTS AND WASHERS (PC1)
5	1	NOS	STEEL CROSSARM CHANNEL ( 50x100x1200 ) mm.
6	1	NOS	POLE CLAMP WITH NUTS, BOLTS AND WASHERS (PC2)
7	2	NOS	FLAT CROSSARM BRACE (40 X 6 X 660) mm
8	1	LOT	BOLTS WITH SUITABLE NUTS AND WASHERS
9	1	SET	HT STAY (TYPE AS REQUIRED)
10	1	NOS	PSC POLE – 11m

**CONSTRUCTION STANDARDS  
11 kV DEAD END STRUCTURE (DE)  
PSC POLE**

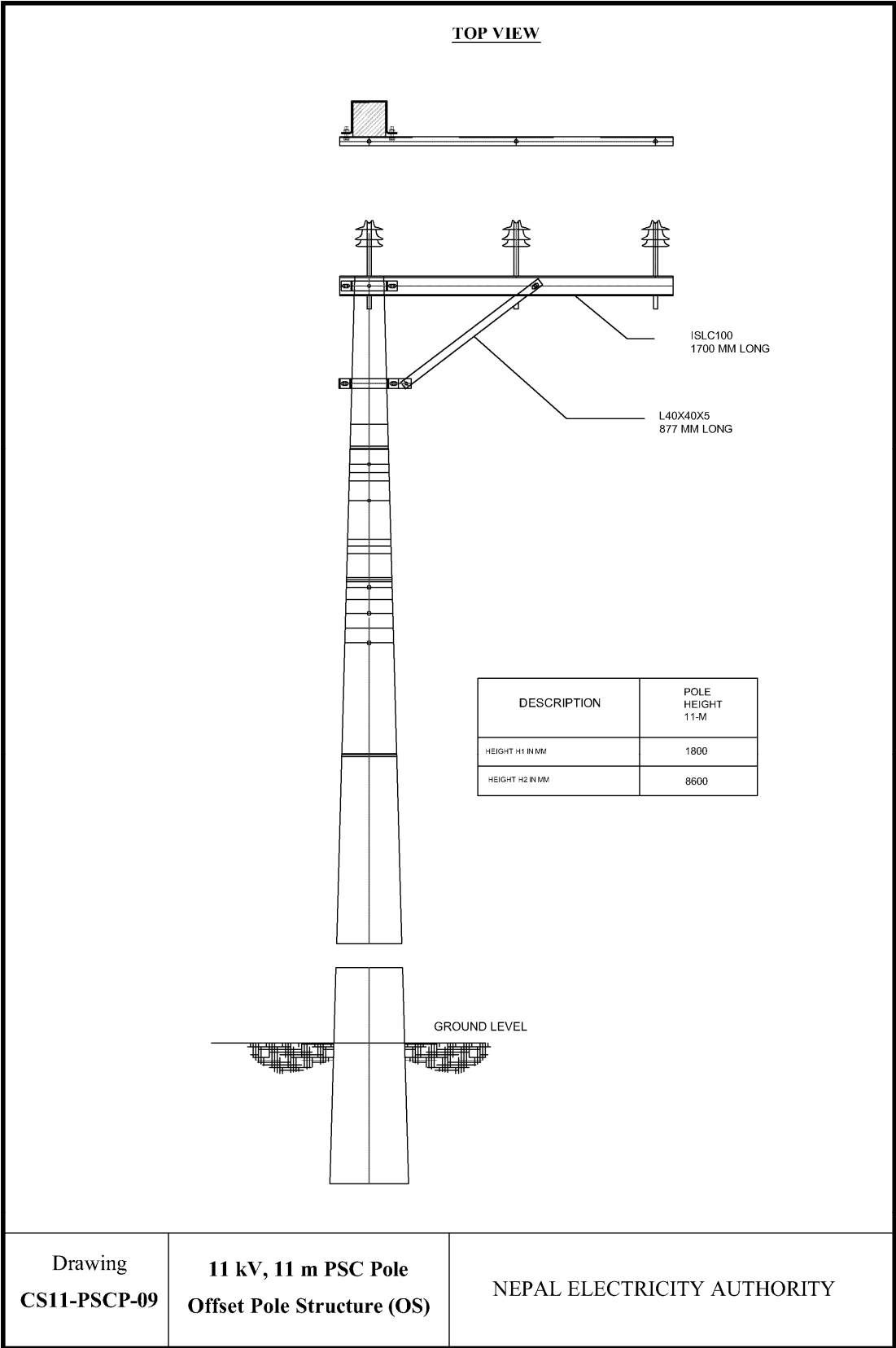
**NEPAL ELECTRICITY AUTHORITY**



S.No.	QTY.	UNIT	MATERIAL
1	3	NOS	PIN INSULATOR WITH PIN AND NUTS/WASHER
2	6	SET	DISC INSULATOR WITH HARDWARE
3	6	NOS	DEAD END CLAMPS
4	2	NOS	STEEL CROSSARM CHANNEL ( 50x100x300 ) mm.
5	2	NOS	STEEL CROSSARM CHANNEL ( 50x100x1200 ) mm.
6	4	NOS	FLAT CROSSARM BRACE (40 X 6 X 660) mm
7	1	LOT	BOLTS WITH SUITABLE NUTS AND WASHERS
8	3	NOS	PREFORMED WIRE (TOP TIE)
9	3	NOS	INSULATED PIERCING CONNECTOR
10	1	NOS	PSC POLE - 11 M

**CONSTRUCTION STANDARDS  
11 kV DOUBLE DEAD END STRUCTURE  
(DDE)  
PSC POLE**

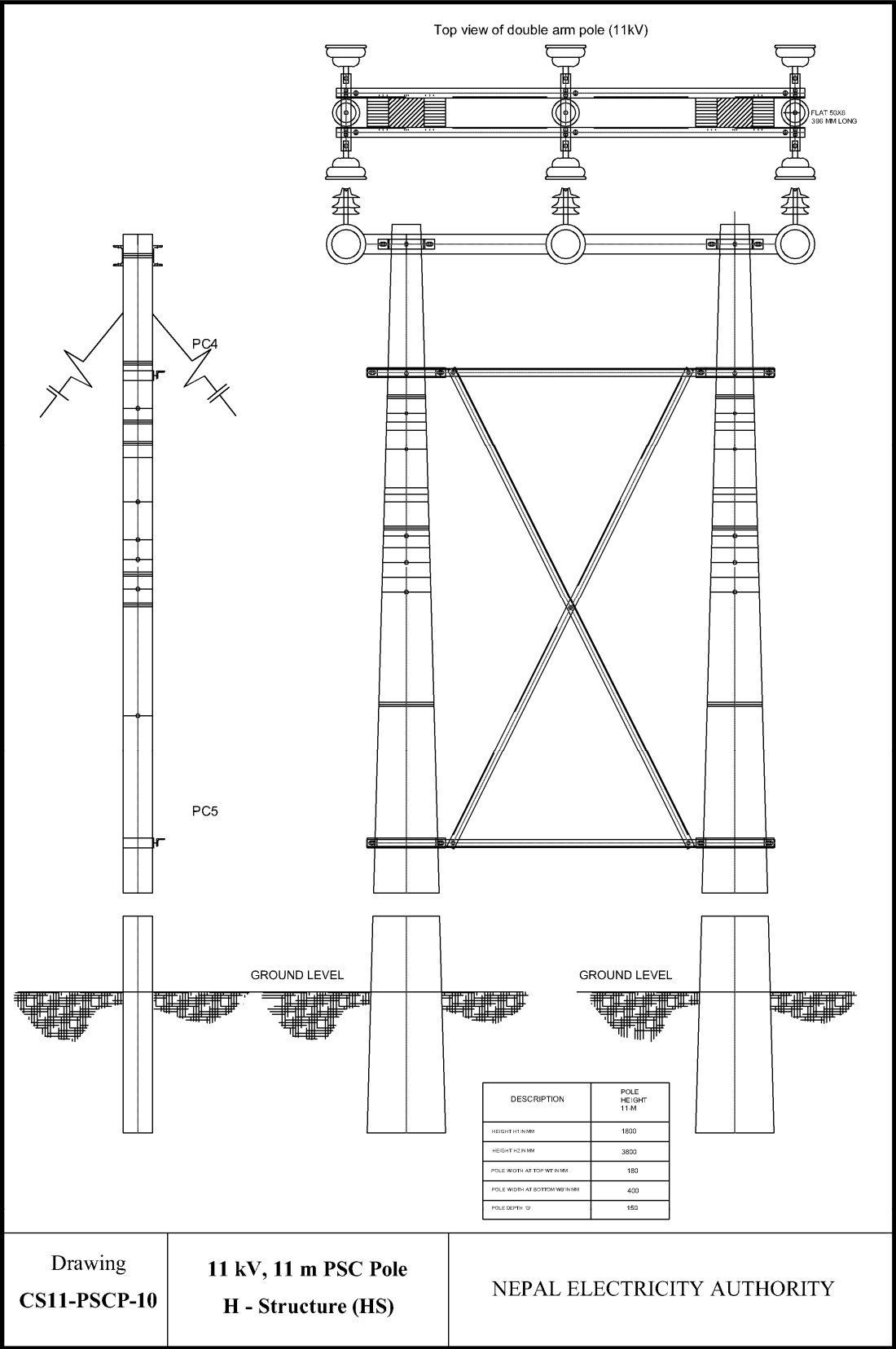
**NEPAL ELECTRICITY AUTHORITY**



S.No.	QTY.	UNIT	MATERIAL
1	3	NOS	PIN INSULATOR WITH PIN AND NUTS/WASHER
2	1	NOS	STEEL CROSSARM CHANNEL ( 50x100x1700 ) mm.
3	1	NOS	POLE CLAMP WITH NUTS, BOLTS AND WASHERS (PC1)
4	1	NOS	BRACING ANGLE FOR OFFSET STRUCTURE (827 X 40 X 5) mm
5	1	NOS	POLE CLAMP WITH NUTS, BOLTS AND WASHERS (PC2)
6	4	NOS	FLAT BRACE FOR OFFSET STRUCTURE (40 X 6 X 374) mm
7	1	LOT	BOLTS WITH SUITABLE NUTS AND WASHERS
8	3	NOS	PREFORMED WIRE (TOP TIE)
9	1	NOS	PSC POLE - 11 M

**CONSTRUCTION STANDARDS**  
**11 kV OFF SET STRUCTURE (OS)**  
**PSC POLE**

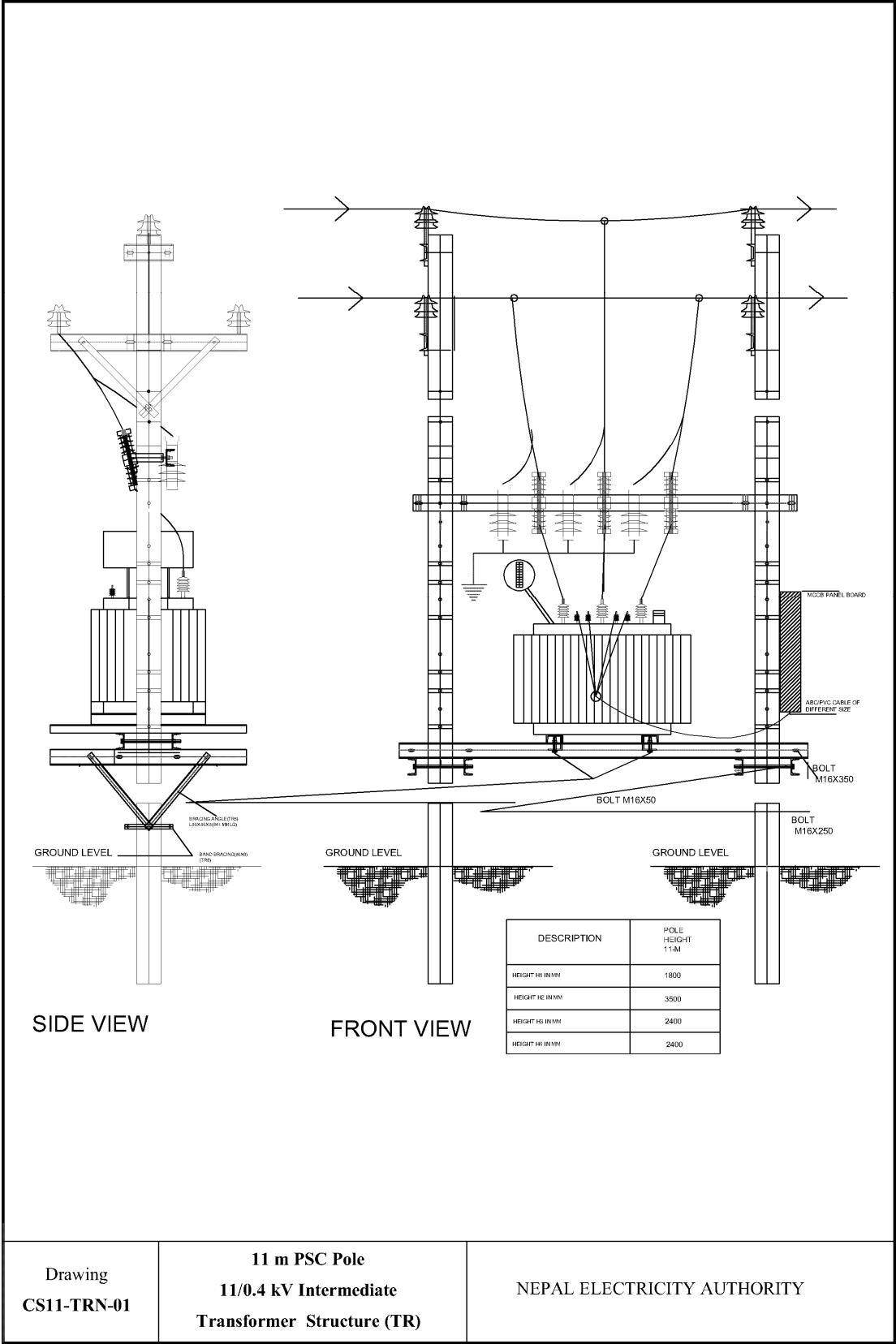
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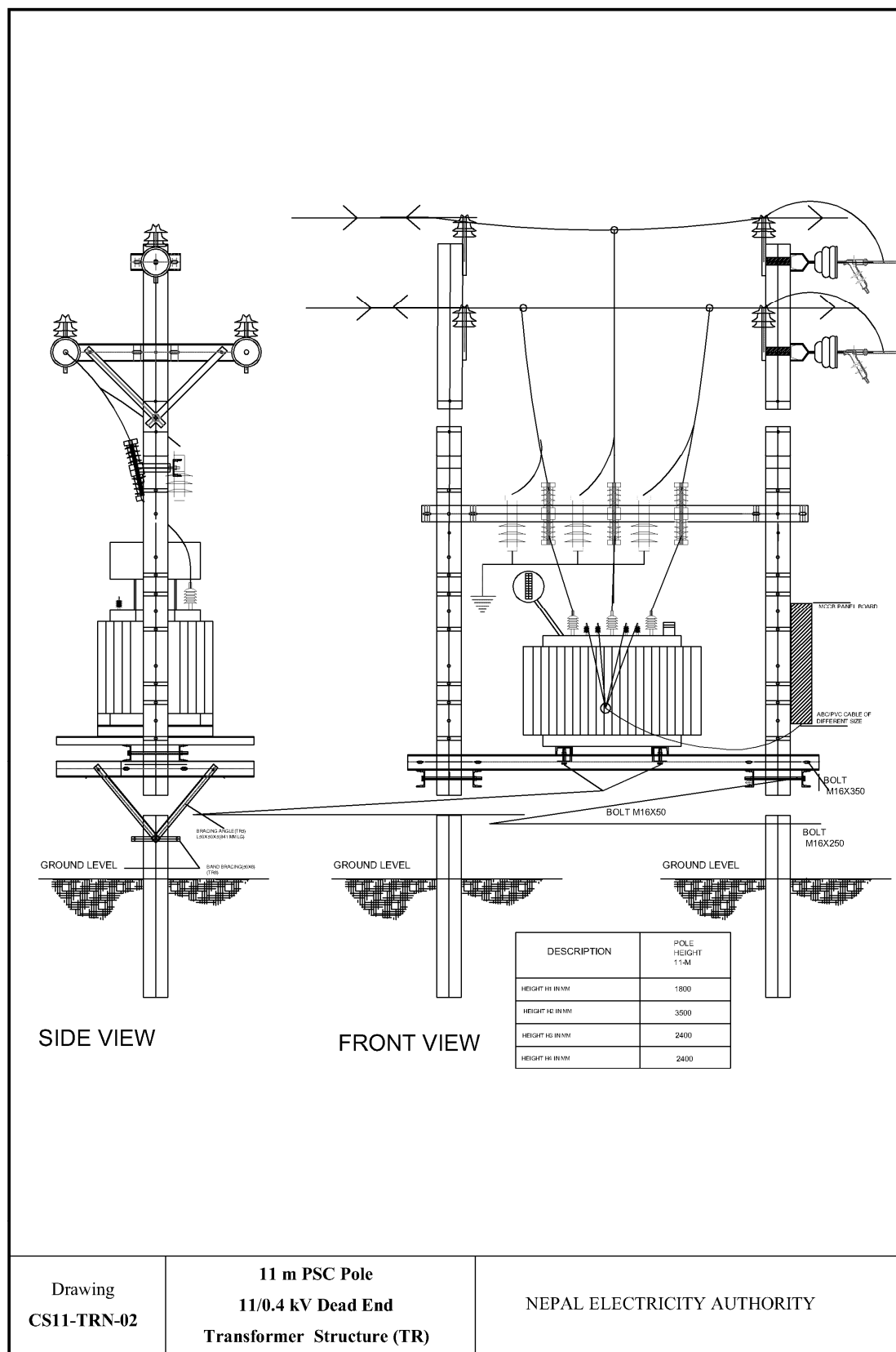


S.No.	QTY.	UNIT	MATERIAL
1	3	NOS	PIN INSULATOR WITH PIN AND NUTS/WASHER
2	6	SET	DISC INSULATOR WITH HARDWARE
3	6	NOS	DEAD END CLAMPS
4	1	NOS	STEEL CROSSARM CHANNEL ( 50x100x6.4 x2390 ) mm.
5	2	NOS	POLE CLAMP WITH NUTS, BOLTS AND WASHERS (PC1)
6	2	NOS	BRACING ANGLE ( 40 x 40 x 5 x 2071 ) mm.
7	2	NOS	POLE CLAMP WITH NUTS, BOLTS AND WASHERS (PC4)
8	2	NOS	POLE CLAMP WITH NUTS, BOLTS AND WASHERS (PC5)
9	2	NOS	BRACING ANGLE ( 40 x 40 x 5 x 2723 ) mm.
10	1	LOT	BOLTS WITH SUITABLE NUTS AND WASHERS
11	3	NOS	PREFORMED TIE (TOP TIE)
12	3	NOS	INSULATED PIERCING CONNECTORS
13	1	SET	HT STAY SET (TYPE AS REQUIRED)
14	2	NOS	PSC POLE - 11 M

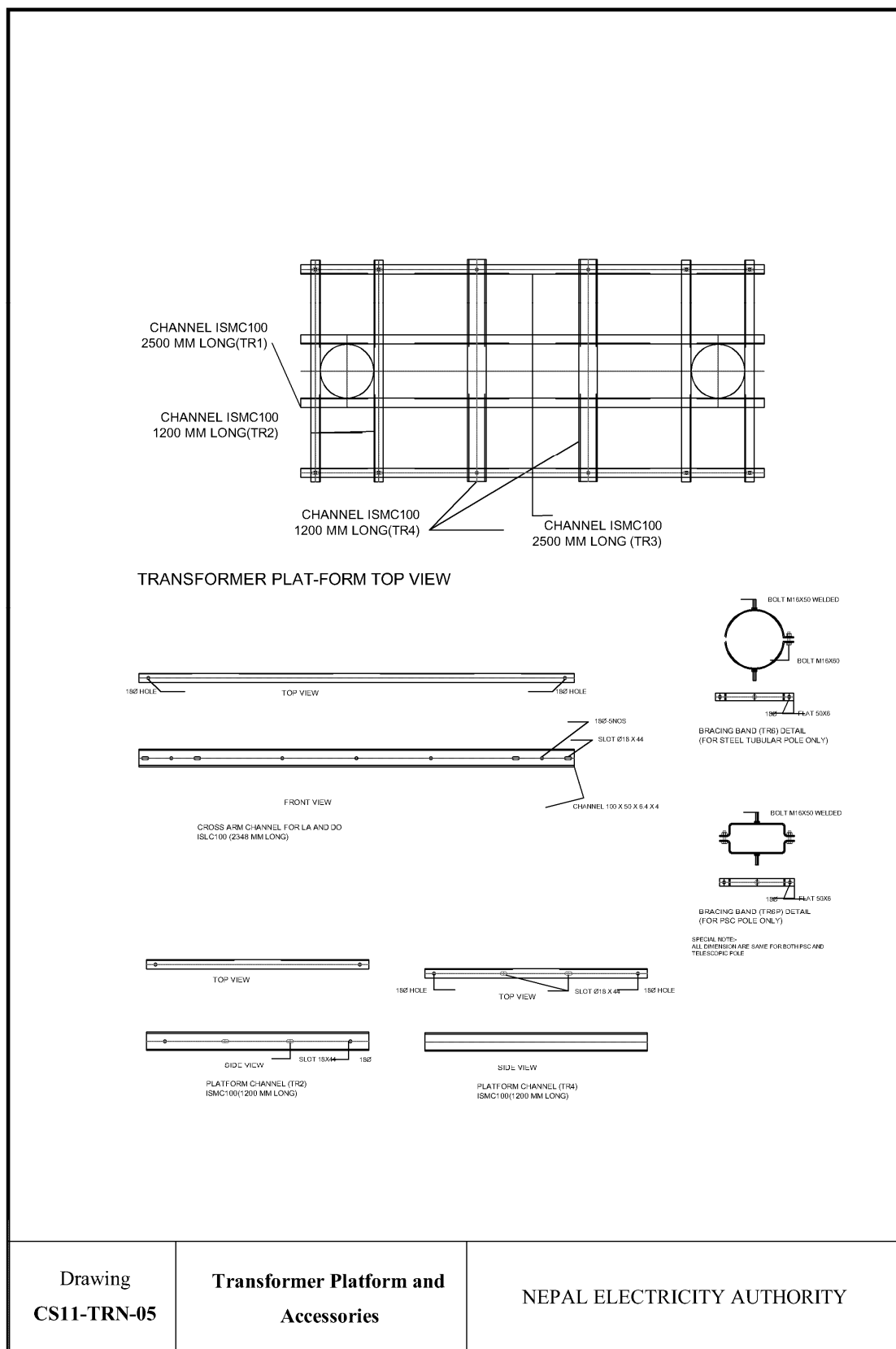
**CONSTRUCTION STANDARDS**  
**11 kV H - STRUCTURE (HS)**  
**PSC POLE**

**NEPAL ELECTRICITY AUTHORITY**

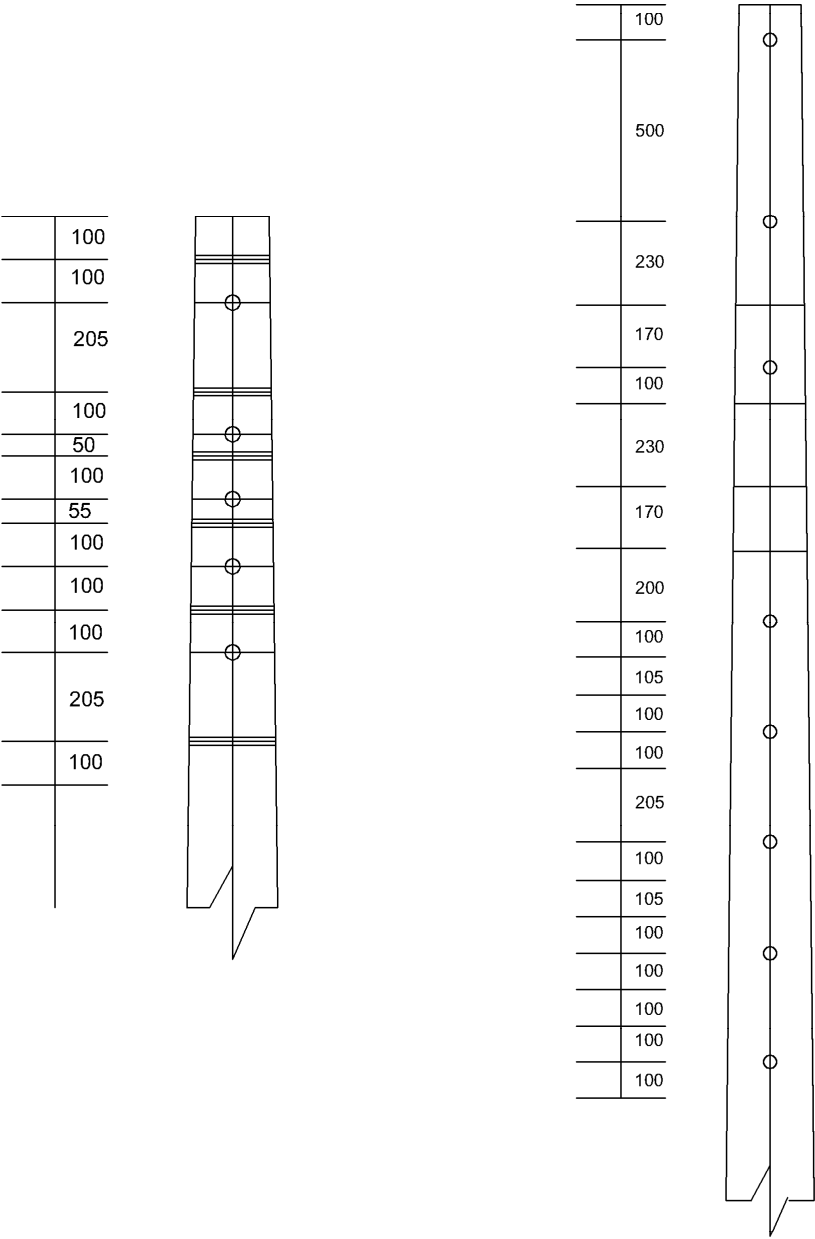




Refer Drawing No: CS11 - TRN - 01 - 04			
S.No.	QTY.	UNIT	MATERIAL
1	6	NOS	PIN INSULATOR WITH PIN AND NUTS/WASHER
2	2	NOS	STEEL CROSSARM CHANNEL ( 50x100x6.4 x300 ) mm.
3	2	NOS	POLE CLAMP WITH NUTS, BOLTS AND WASHERS (PC1)
4	2	NOS	STEEL CROSSARM CHANNEL ( 500x100x 6.4 x 1200 ) mm.
5	2	NOS	POLE CLAMP WITH NUTS, BOLTS AND WASHERS (PC2)
6	4	NOS	FLAT CROSS ARM
7	3	NOS	9 kV SURGE ARRESTOR
8	3	NOS	DISTRIBUTION CUTOUT WITH FUSE HOLDERS
9	1	NOS	CHANNEL FOR LA & DO ISLC 100 2348 MM
10	2	NOS	PLATFORM CHANNEL (TR1) ISMC 100 2500 MM
11	2	NOS	PLATFORM CHANNEL (TR3) ISMC 100 2500 MM
12	4	NOS	PLATFORM CHANNEL (TR2) ISMC 100 1200 MM
13	2	NOS	PLATFORM CHANNEL (TR4) ISMC 100 1200 MM
14	8	NOS	BRACING ANGLE (TR5) 50 X 50 X 5 841 MM
15	2	SET	BRACING BAND (TR6 OR TR6P) WITH 2-M16 BOLT, 2-M16 X 50 BOLT, 8-M16 NUT, 8-M16 WASHER
16	16	NOS	M16 X 50 BOLT WITH 2-M16 NUT, 2-M16 WASHER
17	8-STTP 12-PSC	NOS	M16 X 250 BOLT WITH 2-M16 NUT, 2-M16 WASHER
18	8-STTP 12-PSC	NOS	M16 X 350 BOLT WITH 2-M16 NUT, 2-M16 WASHER
19	1	NOS	TRANSFORMER
20	3	NOS	TRANSFORMER EARTHING
21	AS REQ.	M	GROUNDING CONDUCTOR (COPPER)
22	6	NOS	PREFORM TIES
23	2	NOS	STEEL TUBULAR POLE/ PSC POLE
CONSTRUCTION STANDARDS 11/0.4 kV TRANSFORMER STRUCTURE TELESCOPIC/PSC POLE (INTERMEDIATE)			NEPAL ELECTRICITY AUTHORITY



**Steel Tubular Pole (STP)**



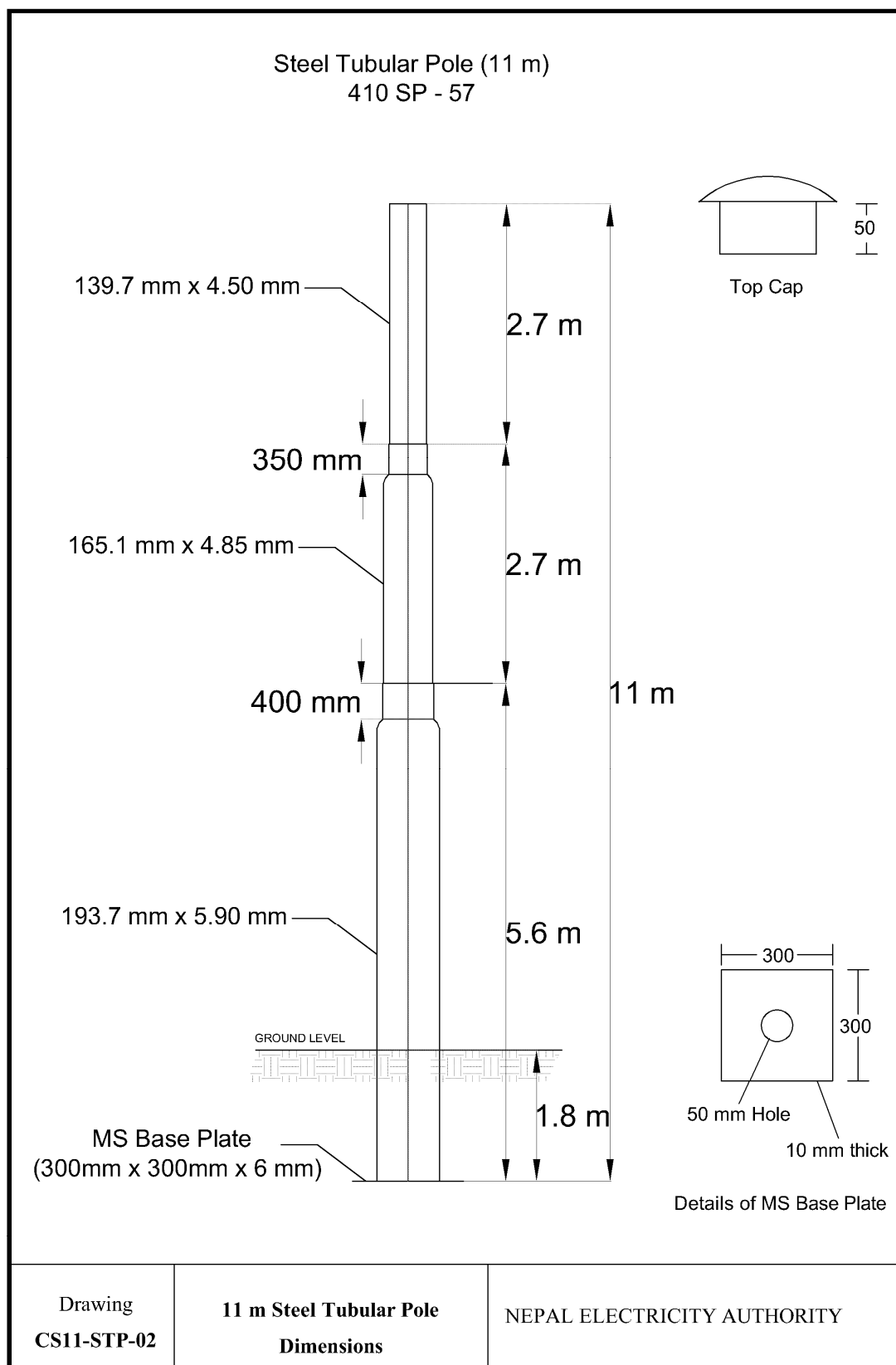
9 Meter STP

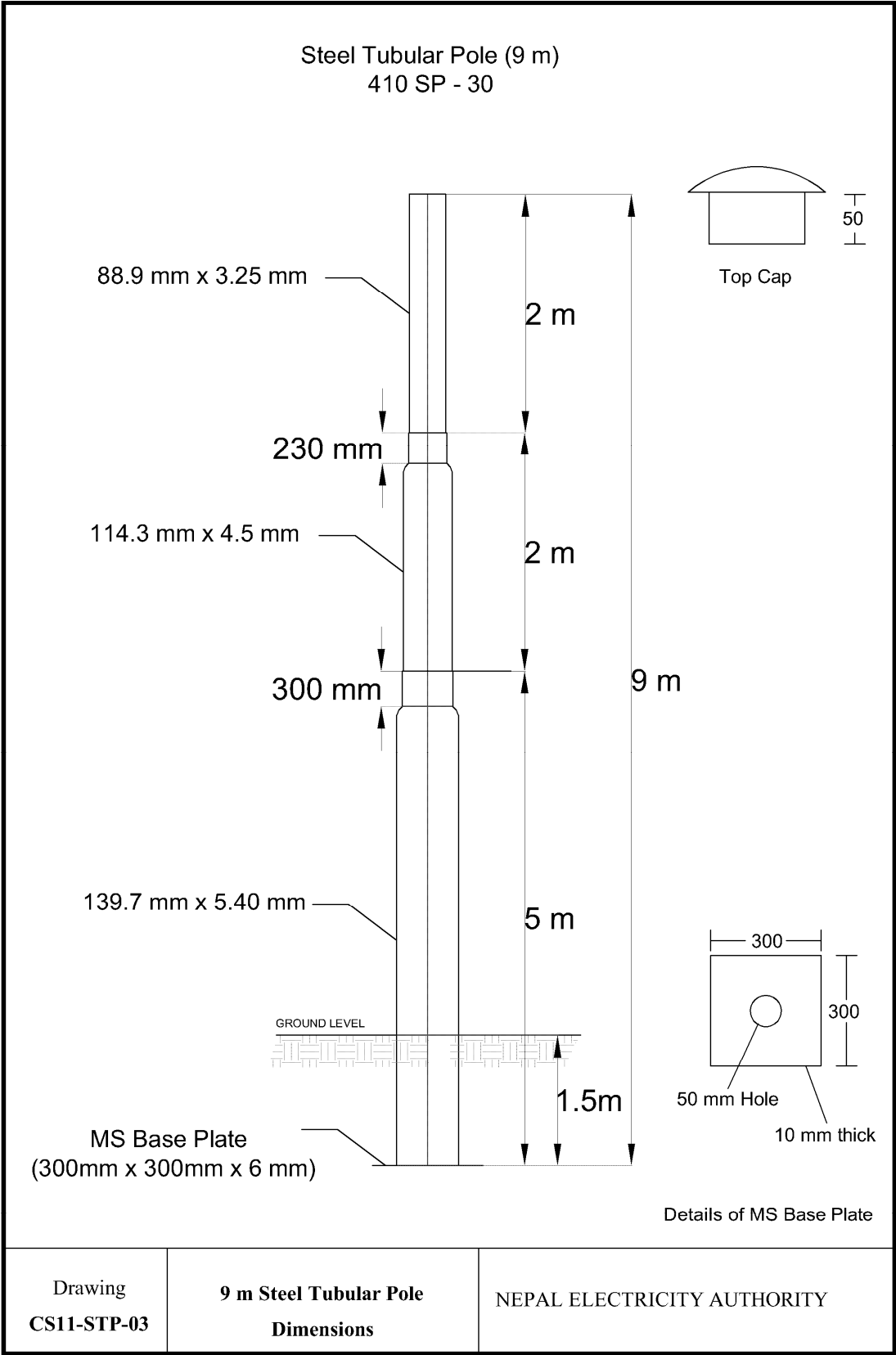
11 Meter STP

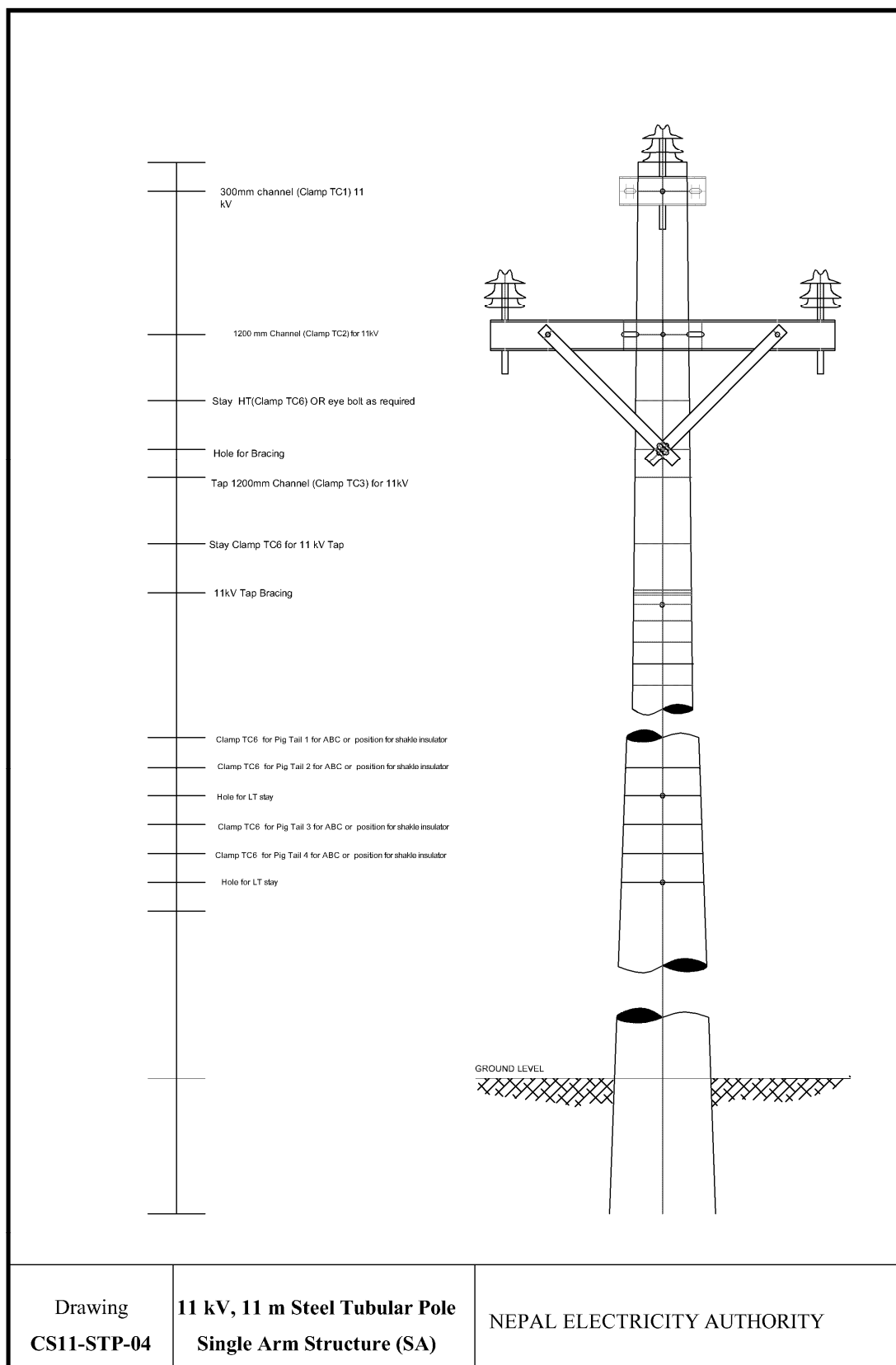
Hole diameter is 18 mm

Note: All dimensions are in mm

Drawing CS11-STP-01	9/11 m Steel Tubular Pole Hole Pattern	NEPAL ELECTRICITY AUTHORITY
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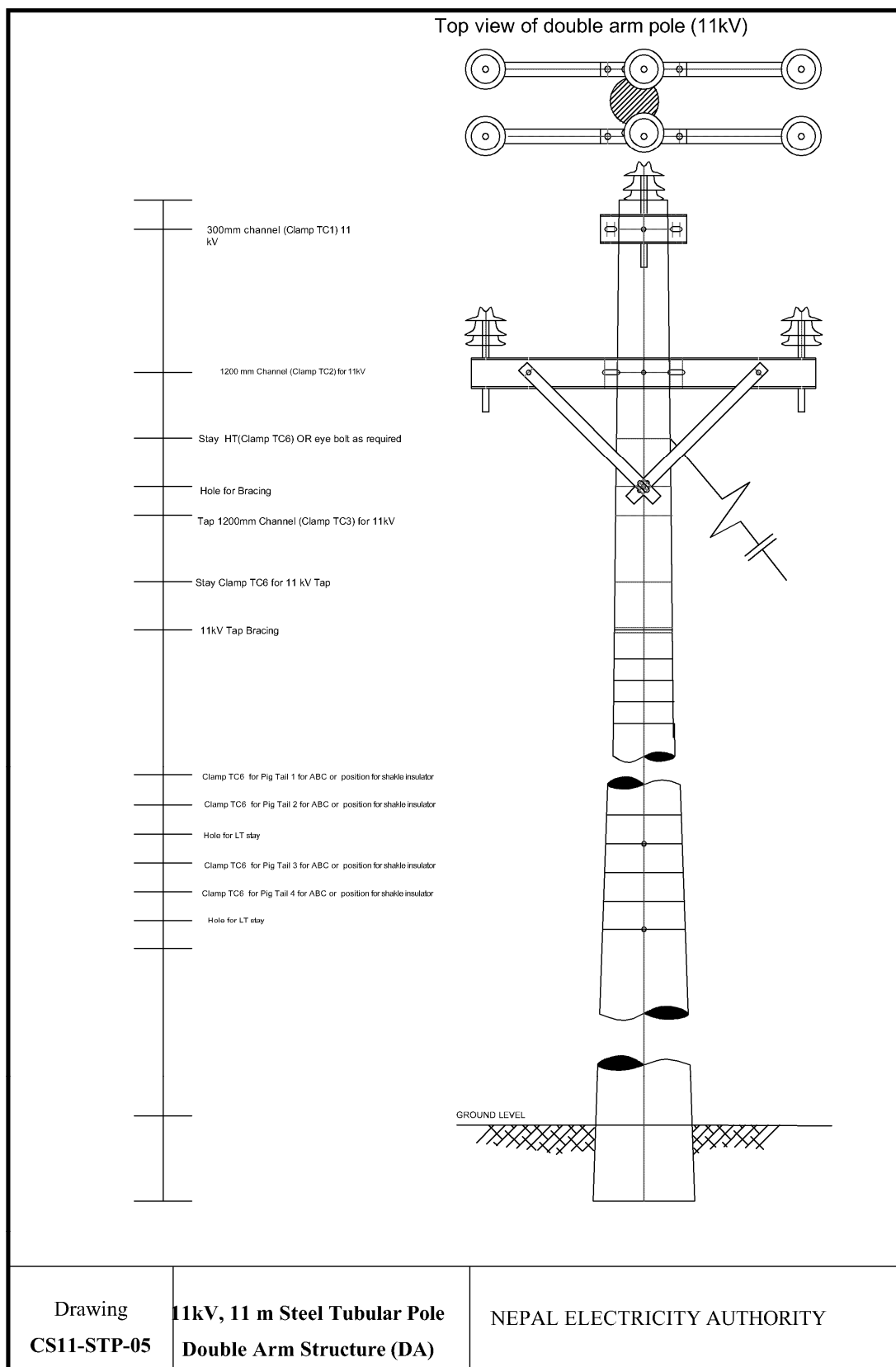




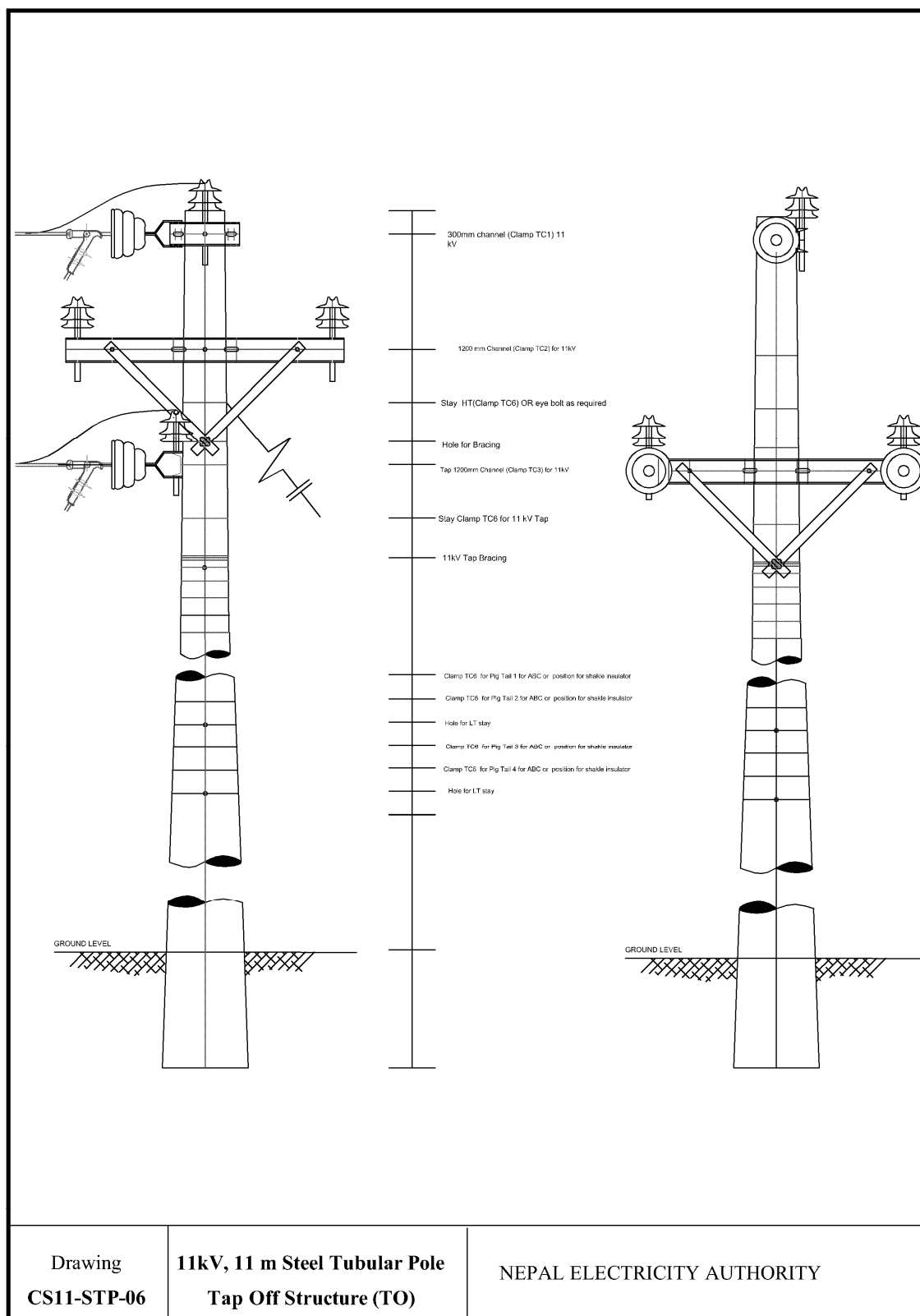
S.No.	QTY.	UNIT	MATERIAL
1	3	NOS	PIN INSULATOR WITH PIN AND NUTS/WASHER
2	1	NOS	STEEL CROSSARM CHANNEL ( 50x100x300 ) mm.
3	1	NOS	POLE CLAMP WITH NUTS, BOLTS AND WASHERS (TC1)
4	1	NOS	STEEL CROSSARM CHANNEL ( 50x100x1200 ) mm.
5	1	NOS	POLE CLAMP WITH NUTS, BOLTS AND WASHERS (TC2)
6	2	NOS	FLAT CROSSARM BRACE (40 X 6 X 660) mm
7	1	LOT	BOLTS WITH SUITABLE NUTS AND WASHERS
8	3	NOS	PREFORMED WIRE (TOP TIE)
9	1	NOS	STEEL TUBULAR POLE 11 M

**CONSTRUCTION STANDARDS**  
**11 kV SINGLE ARM STRUCTURE (SA)**  
**STEEL TUBULAR POLE**

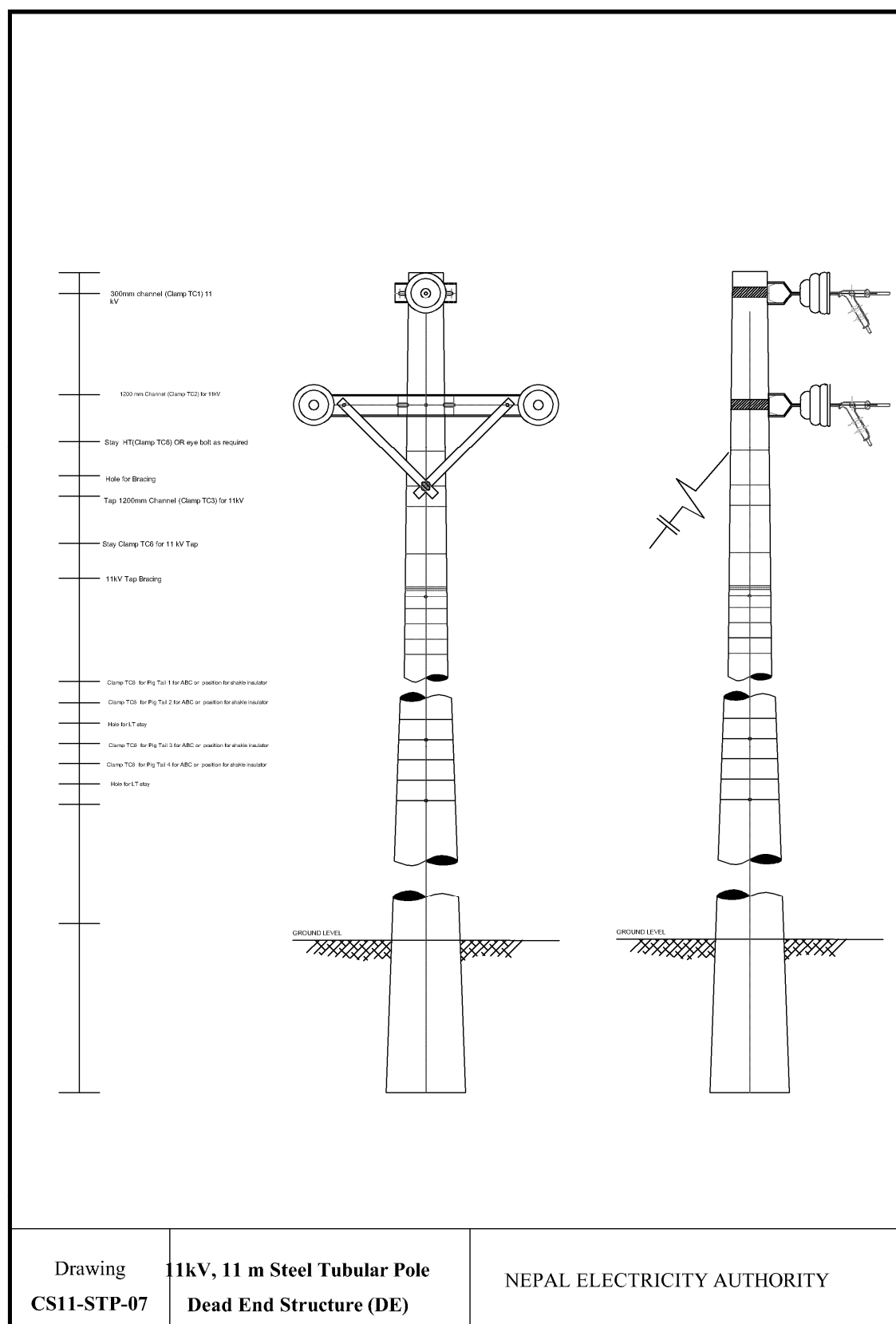
**NEPAL ELECTRICITY AUTHORITY**



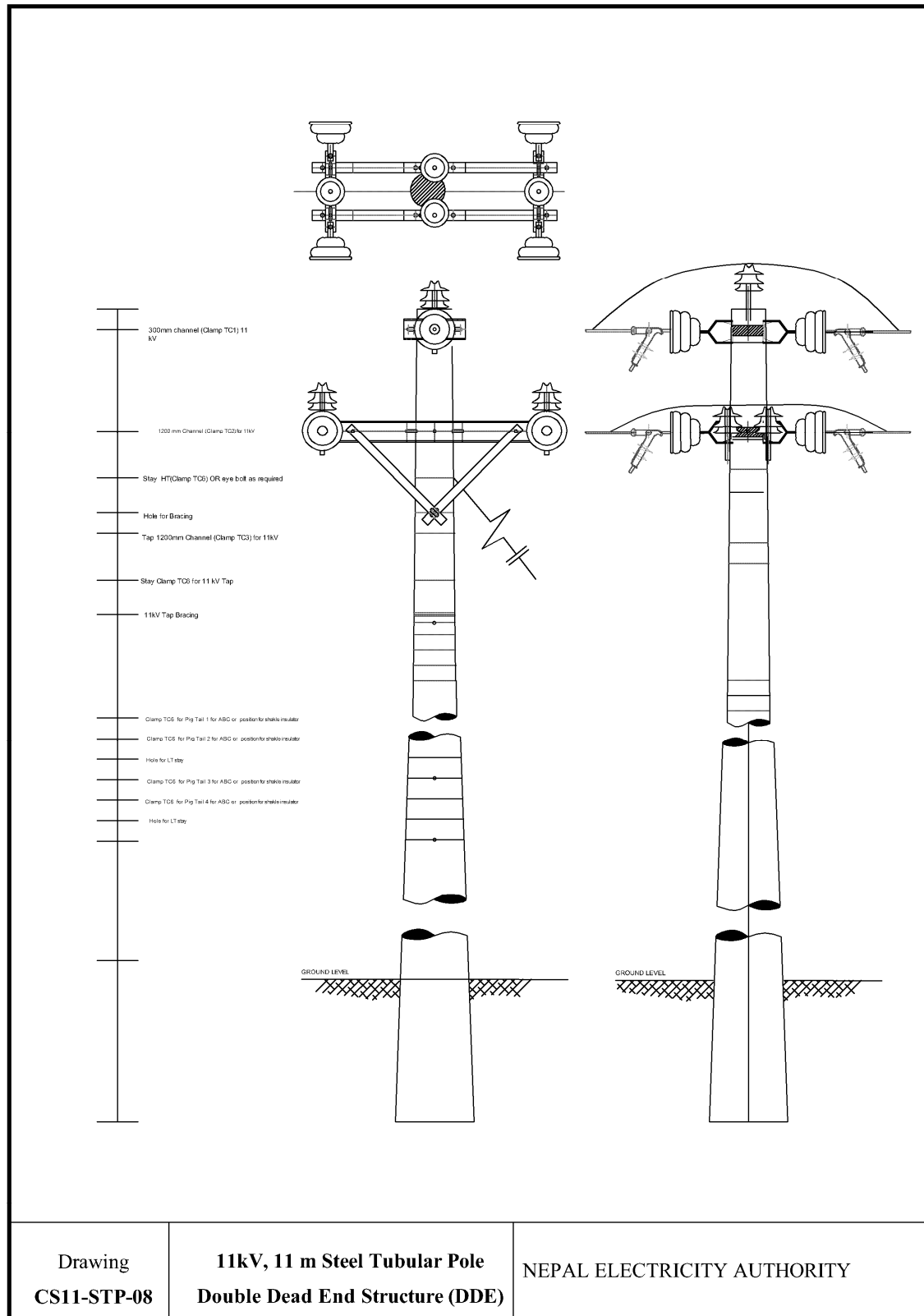
S.No.	QTY.	UNIT	MATERIAL
1	6	NOS	PIN INSULATOR WITH PIN AND NUTS/WASHER
2	2	NOS	STEEL CROSSARM CHANNEL ( 50x100x300 ) mm.
3	2	NOS	STEEL CROSSARM CHANNEL ( 50x100x1200 ) mm.
4	4	NOS	FLAT CROSSARM BRACE (40 X 6 X 660) mm
5	1	LOT	BOLTS WITH SUITABLE NUTS AND WASHERS
6	6	NOS	PREFORMED WIRE (DOUBLE SIDE TIES)
7	1	NOS	STEEL TUBULAR POLE - 11 M
CONSTRUCTION STANDARDS 11 kV DOUBLE ARM STRUCTURE (DA) STEEL TUBULAR POLE			NEPAL ELECTRICITY AUTHORITY



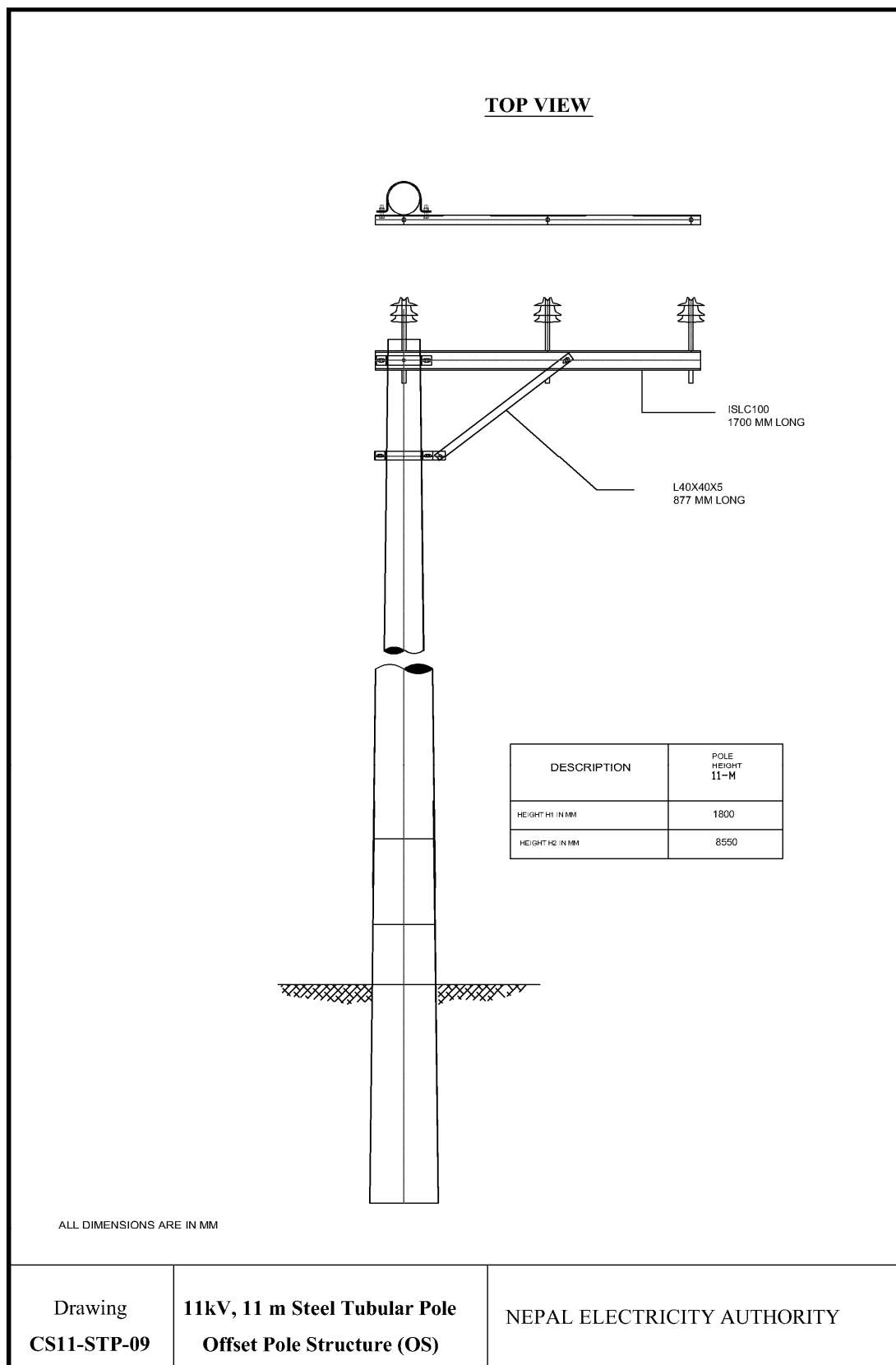
S.No.	QTY.	UNIT	MATERIAL
1	5	NOS	PIN INSULATOR WITH PIN AND NUTS/WASHER
2	3	SET	DISC INSULATOR WITH HARDWARE
3	3	NOS	DEAD END CLAMPS
4	1	NOS	STEEL CROSSARM CHANNEL ( 50x100x300 ) mm.
5	1	NOS	POLE CLAMP WITH NUTS, BOLTS AND WASHERS (TC1)
6	2	NOS	STEEL CROSSARM CHANNEL ( 50x100x1200 ) mm.
7	1	NOS	POLE CLAMP WITH NUTS, BOLTS AND WASHERS (TC3)
8	4	NOS	FLAT CROSSARM BRACE (40 X 6 X 660) mm
9	1	LOT	BOLTS WITH SUITABLE NUTS AND WASHERS
10	5	NOS	PREFORMED WIRE (TOP TIE)
11	3	NOS	INSULATED PIERCING CONNECTORS
12	1	SET	HT STAY (TYPE AS REQUIRED)
13	1	NOS	STEEL TUBULAR POLE - 11 M
CONSTRUCTION STANDARDS 11 kV TAP OFF STRUCTURE (TO) STEEL TUBULAR POLE			NEPAL ELECTRICITY AUTHORITY



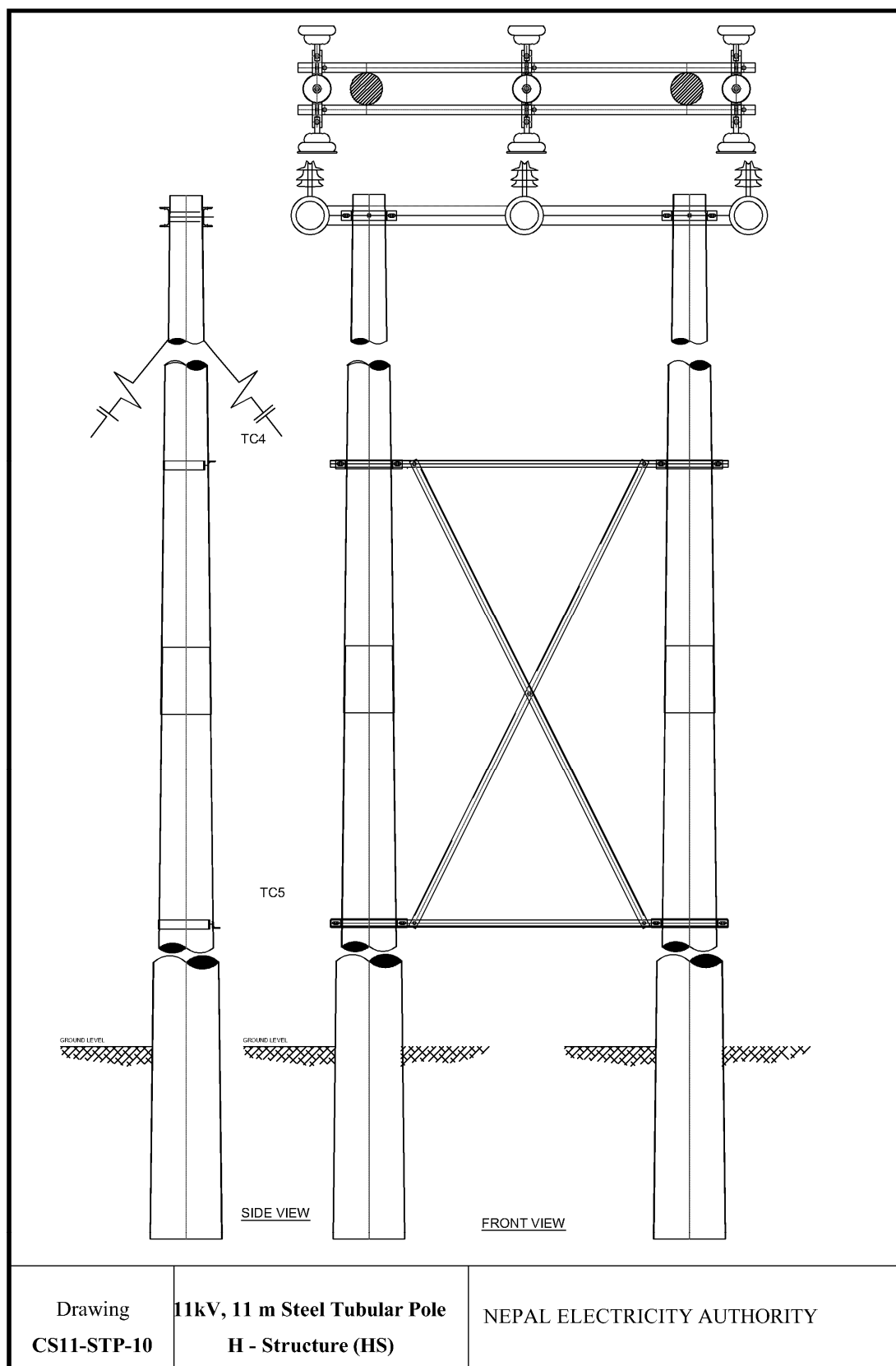
S.No.	QTY.	UNIT	MATERIAL
1	3	NOS	DISC INSULATOR WITH HARDWARE
2	3	NOS	DEAD END CLAMPS
3	1	NOS	STEEL CROSSARM CHANNEL ( 50x100x300 ) mm.
4	1	NOS	POLE CLAMP WITH NUTS, BOLTS AND WASHERS (T)
5	1	NOS	STEEL CROSSARM CHANNEL ( 50x100x1200 ) mm.
6	1	NOS	POLE CLAMP WITH NUTS, BOLTS AND WASHERS (TC2)
7	2	NOS	FLAT CROSSARM BRACE (40 X 6 X 660) mm
8	1	LOT	BOLTS WITH SUITABLE NUTS AND WASHERS
9	1	SET	HT STAY (TYPE AS REQUIRED)
10	1	NOS	STEEL TUBULAR POLE – 11m
CONSTRUCTION STANDARDS 11 kV DEAD END STRUCTURE (DE) STEEL TUBULAR POLE			NEPAL ELECTRICITY AUTHORITY



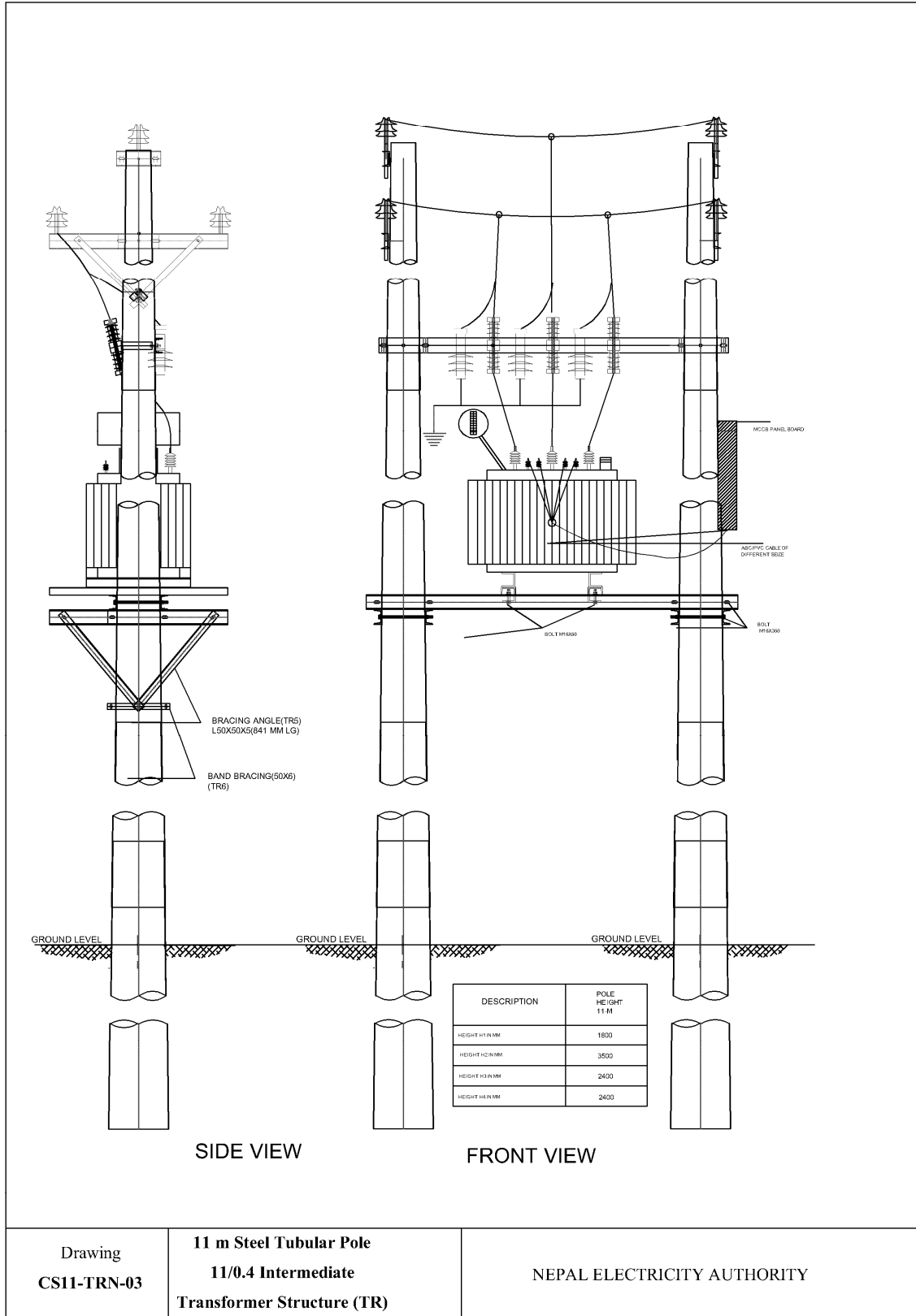
S.No.	QTY.	UNIT	MATERIAL
1	3	NOS	PIN INSULATOR WITH PIN AND NUTS/WASHER
2	6	SET	DISC INSULATOR WITH HARDWARE
3	6	NOS	DEAD END CLAMPS
4	2	NOS	STEEL CROSSARM CHANNEL ( 50x100x300 ) mm.
5	2	NOS	STEEL CROSSARM CHANNEL ( 50x100x1200 ) mm.
6	4	NOS	FLAT CROSSARM BRACE (40 X 6 X 660) mm
7	1	LOT	BOLTS WITH SUITABLE NUTS AND WASHERS
8	3	NOS	PREFORMED WIRE (TOP TIE)
9	3	NOS	INSULATED PIERCING CONNECTOR
10	1	NOS	STEEL TUBULAR POLE - 11 M
CONSTRUCTION STANDARDS 11 kV DOUBLE DEAD END STRUCTURE (DDE) STEEL TUBULAR POLE			NEPAL ELECTRICITY AUTHORITY



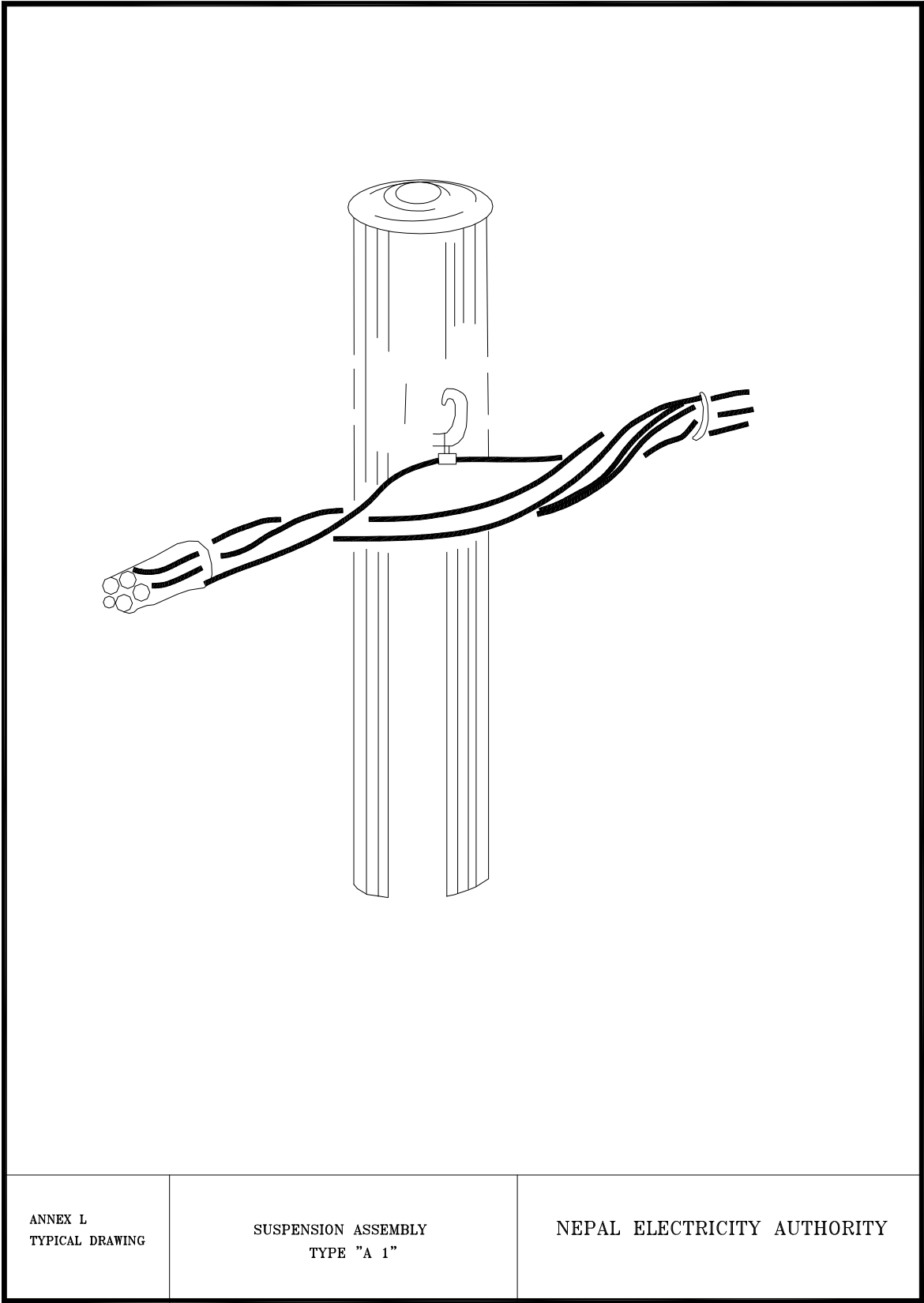
S.No.	QTY.	UNIT	MATERIAL
1	3	NOS	PIN INSULATOR WITH PIN AND NUTS/WASHER
2	1	NOS	STEEL CROSSARM CHANNEL ( 50x100x1700 ) mm.
3	1	NOS	POLE CLAMP WITH NUTS, BOLTS AND WASHERS (TC1)
4	1	NOS	BRACING ANGLE FOR OFFSET STRUCTURE (827 X 40 X 5) mm
5	1	NOS	POLE CLAMP WITH NUTS, BOLTS AND WASHERS (TC2)
6	4	NOS	FLAT BRACE FOR OFFSET STRUCTURE (40 X 6 X 374) mm
7	1	LOT	BOLTS WITH SUITABLE NUTS AND WASHERS
8	3	NOS	PREFORMED WIRE (TOP TIE)
9	1	NOS	STEEL TUBULAR POLE - 11 M
CONSTRUCTION STANDARDS 11 kV OFF SET STRUCTURE (OS) STEEL TUBULAR POLE		NEPAL ELECTRICITY AUTHORITY	



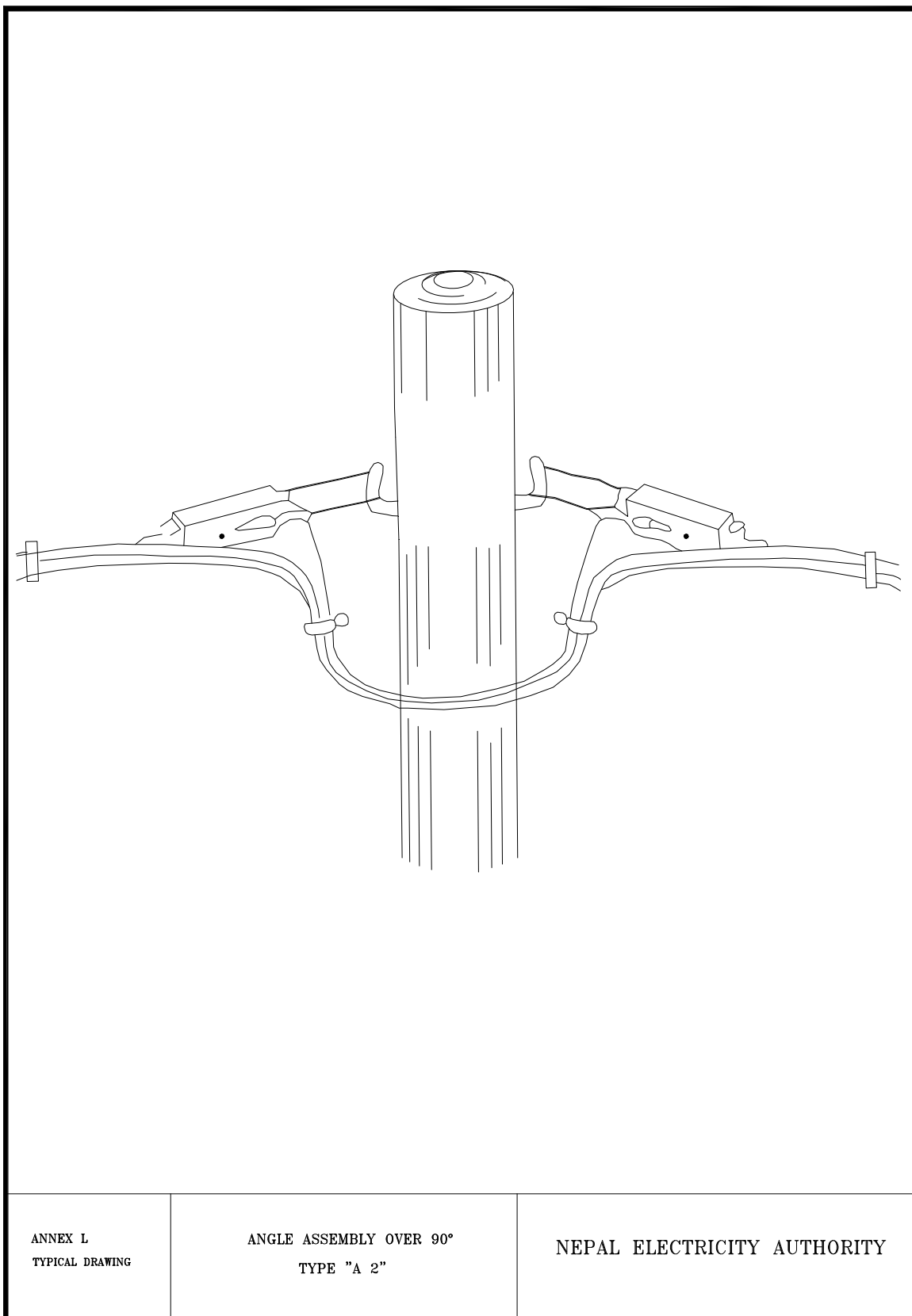
S.No.	QTY.	UNIT	MATERIAL
1	3	NOS	PIN INSULATOR WITH PIN AND NUTS/WASHER
2	6	SET	DISC INSULATOR WITH HARDWARE
3	6	NOS	DEAD END CLAMPS
4	1	NOS	STEEL CROSSARM CHANNEL ( 50x100x6.4 x2390 ) mm.
5	2	NOS	POLE CLAMP WITH NUTS, BOLTS AND WASHERS (TC1)
6	2	NOS	BRACING ANGLE ( 40 x 40 x 5 x 2071 ) mm.
7	2	NOS	POLE CLAMP WITH NUTS, BOLTS AND WASHERS (TC4)
8	2	NOS	POLE CLAMP WITH NUTS, BOLTS AND WASHERS (TC5)
9	2	NOS	BRACING ANGLE ( 40 x 40 x 5 x 2723 ) mm.
10	1	LOT	BOLTS WITH SUITABLE NUTS AND WASHERS
11	3	NOS	PREFORMED TIE (TOP TIE)
12	3	NOS	INSULATED PIERCING CONNECTORS
13	1	SET	HT STAY SET (TYPE AS REQUIRED)
14	2	NOS	STEEL TUBULAR POLE - 11 M
CONSTRUCTION STANDARDS 11 kV H - STRUCTURE (HS) STEEL TUBULAR POLE			NEPAL ELECTRICITY AUTHORITY







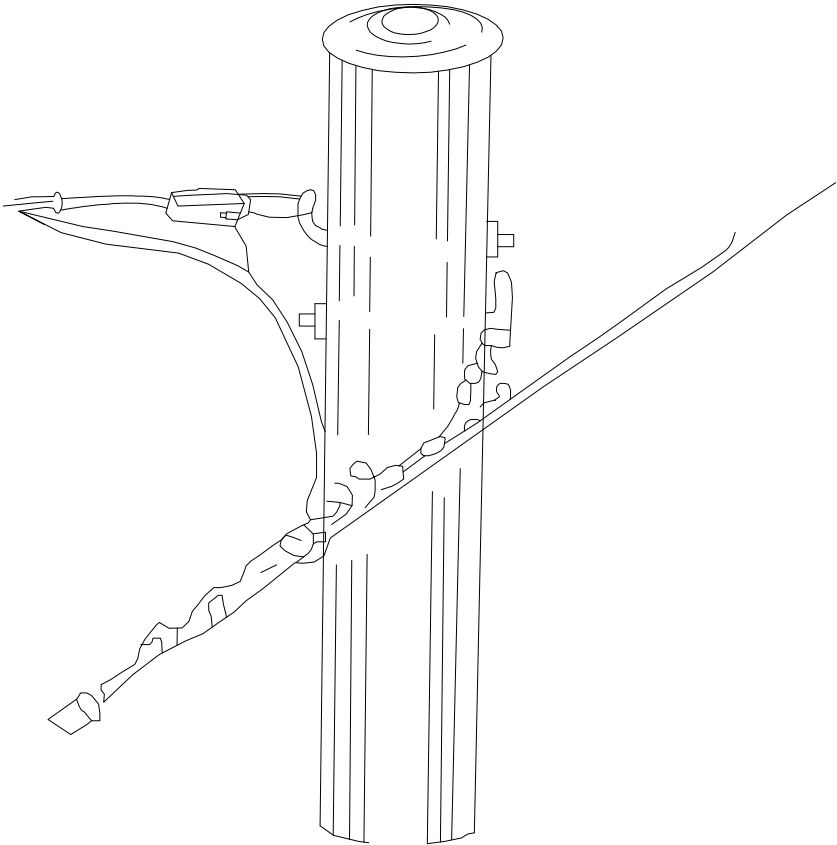
For PSC Pole			
S.NO.	QTY.	UNIT	MATERIAL
1	1	NOS	SUSPENSION CLAMP
2	1 for STP 0 for PSC	NOS	POLE CLAMP WITH NUTS, BOLTS AND WASHERS (TC8)
3	1 for PSC 0 for STP	NOS	PIGTAIL WITH HEXAGONAL NUTS AND WASHERS (16 X 203) MM
4	1	NOS	POLE 9 METER
CONSTRUCTION STANDARDS LV TYPE – A1 (Suspension Type)			NEPAL ELECTRICITY AUTHORITY



S.NO.	QTY.	UNIT	MATERIAL
1	2	NOS	ANCHOR CLAMP
2	2 for PSC 0 for STP	NOS	PIGTAIL WITH HEXAGONAL NUTS AND WASHERS (16 X 203) MM
3	2 for PSC 0 for STP	NOS	EYE NUT
4	2 for STP 0 for PSC	NOS	POLE CLAMP WITH NUTS, BOLTS AND WASHERS (TC8)
5	1	NOS	POLE 9 METER
6	1	SET	LT STAY SET

**CONSTRUCTION STANDARDS**  
**LV TYPE – A2 (Suspension Type**  
**with Angle)**

**NEPAL ELECTRICITY AUTHORITY**



ANNEX L  
TYPICAL DRAWING

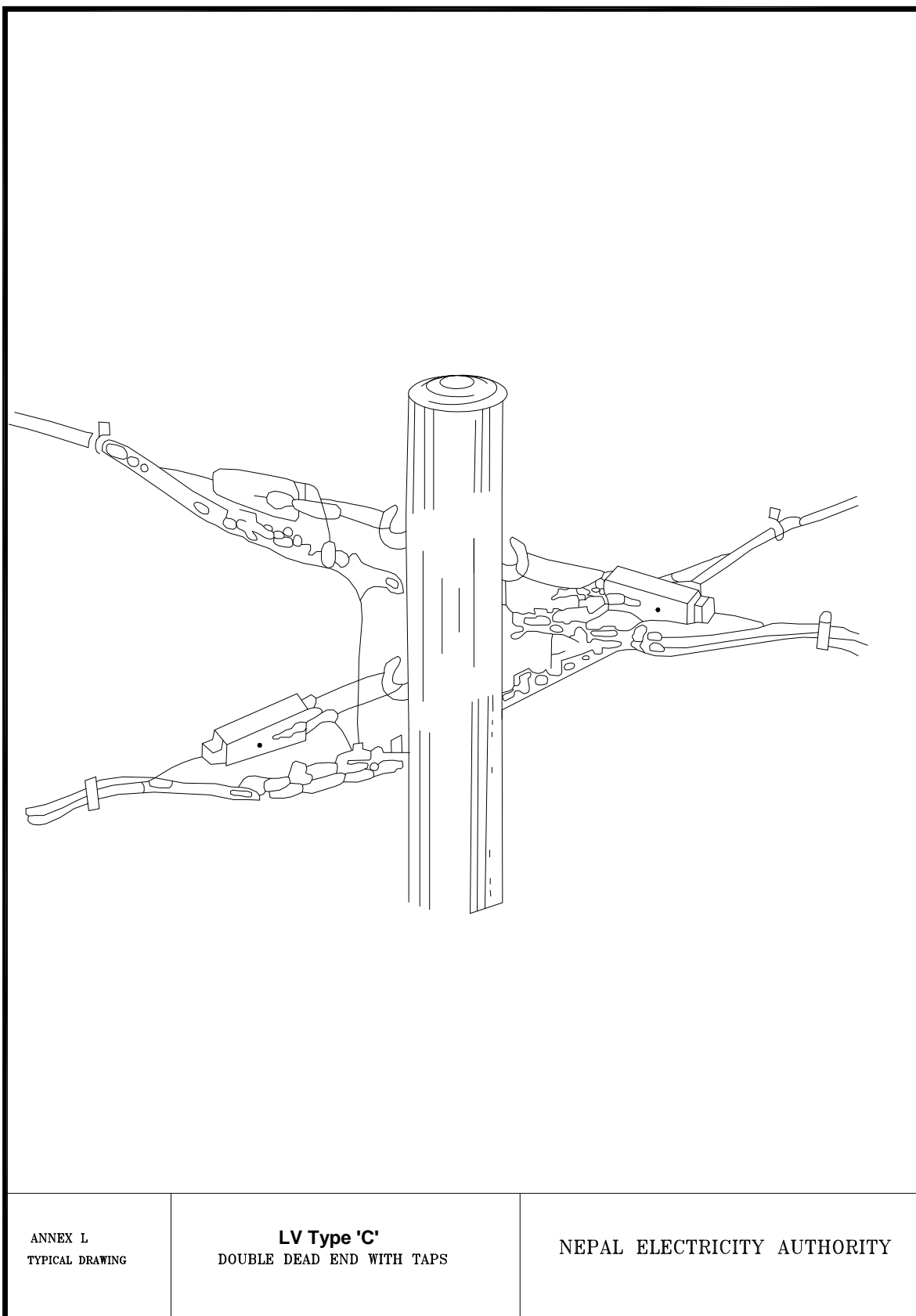
INTERMEDIATE TAP  
TYPE "B"

NEPAL ELECTRICITY AUTHORITY

S.NO.	QTY.	UNIT	MATERIAL
1	1	NOS	SUSPENSION CLAMP
2	1	NOS	ANCHOR CLAMP
3	2 for PSC 0 for STP	NOS	PIGTAIL WITH HEXAGONAL NUTS AND WASHERS (16 X 203) MM
4	1 for PSC 0 for STP	NOS	EYE NUT
5	2 for STP 0 for PSC	NOS	POLE CLAMP WITH NUTS, BOLTS AND WASHERS (TC8)
6	5	NOS	INSULATED PIERCING CONNECTOR
7	5	NOS	INSULATED CABLE CAPS
8	1	NOS	POLE 9 METER
9	1	SET	LT STAY

**CONSTRUCTION STANDARDS**  
**LV TYPE - B (Suspension with an Anchor for**  
**Dead)**

**NEPAL ELECTRICITY AUTHORITY**

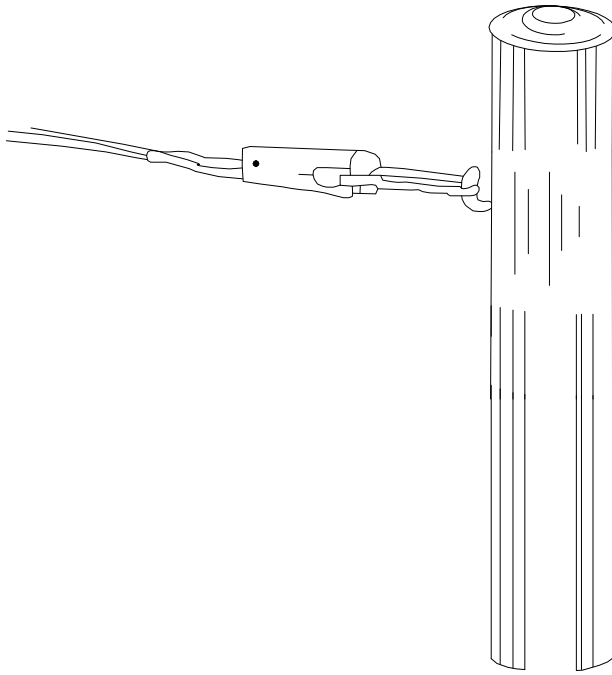


S.NO.	QTY.	UNIT	MATERIAL
1	4	NOS	ANCHOR CLAMP
2	2 for PSC 0 for STP	NOS	PIGTAIL WITH HEXAGONAL NUTS AND WASHERS (16 X 203) MM
3	1 for PSC 0 for STP	NOS	EYE NUT
4	2 for STP 0 for PSC	NOS	POLE CLAMP WITH NUTS, BOLTS AND WASHERS (TC8)
5	15	NOS	INSULATED PIERCING CONNECTOR
6	20	NOS	INSULATED CABLE CAPS
7	1	NOS	POLE 9 METER
CONSTRUCTION STANDARDS LV TYPE - C (Four Anchor Dead End)			NEPAL ELECTRICITY AUTHORITY

S.NO.	QTY.	UNIT	MATERIAL
1	1	NOS	SUSPENSION CLAMP
2	2	NOS	ANCHOR CLAMP
3	2 for PSC 0 for STP	NOS	PIGTAIL WITH HEXAGONAL NUTS AND WASHERS (16 X 203) MM
4	2 for PSC 0 for STP	NOS	EYE NUT
5	2 for STP 0 for PSC	NOS	POLE CLAMP WITH NUTS, BOLTS AND WASHERS (TC8)
6	10	NOS	INSULATED PIERCING CONNECTOR
7	10	NOS	INSULATED CABLE CAPS
8	1	NOS	POLE 9 METER

**CONSTRUCTION STANDARDS**  
**LV TYPE - D (One Suspension with two anchor dead end)**

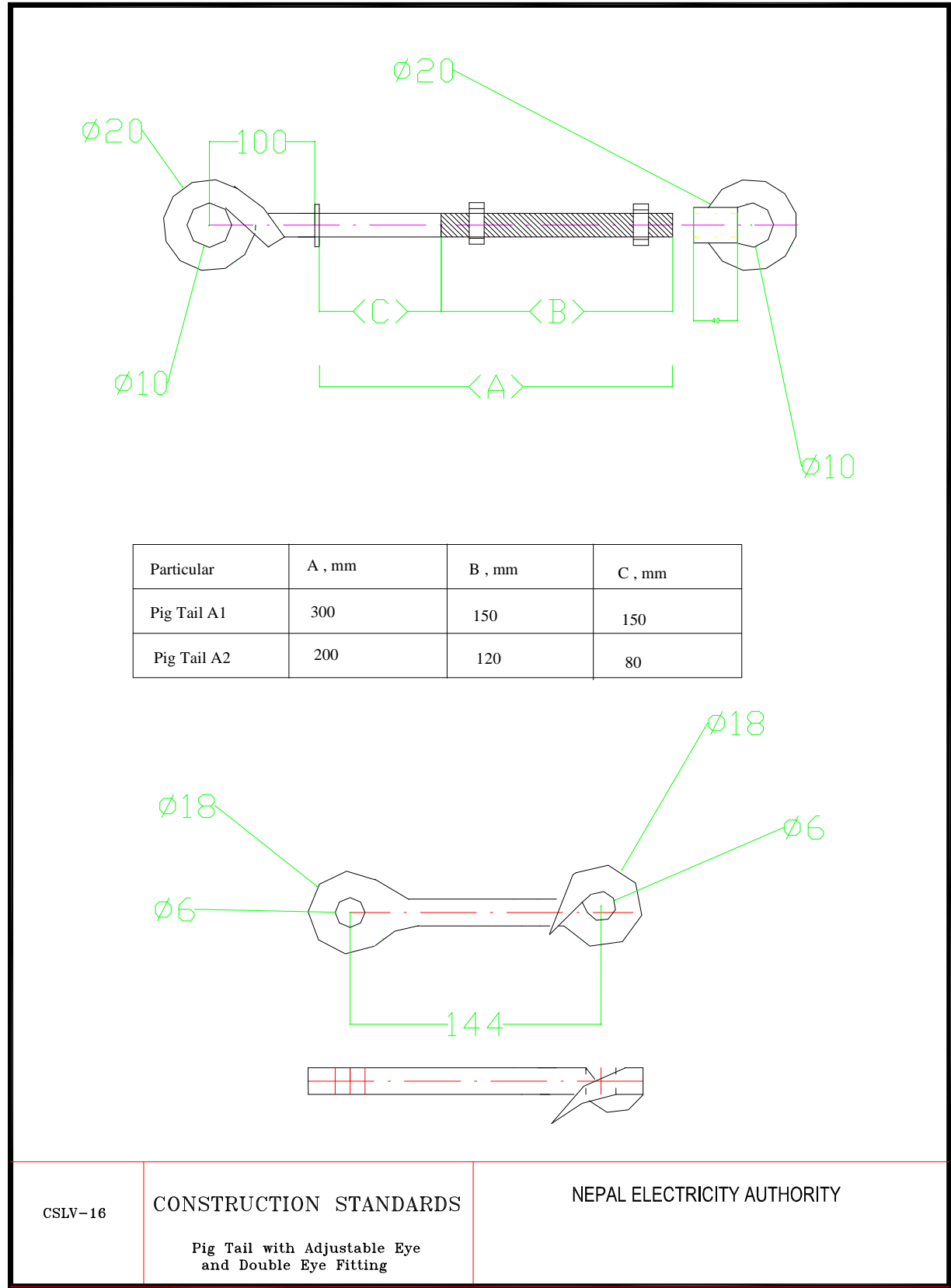
**NEPAL ELECTRICITY AUTHORITY**

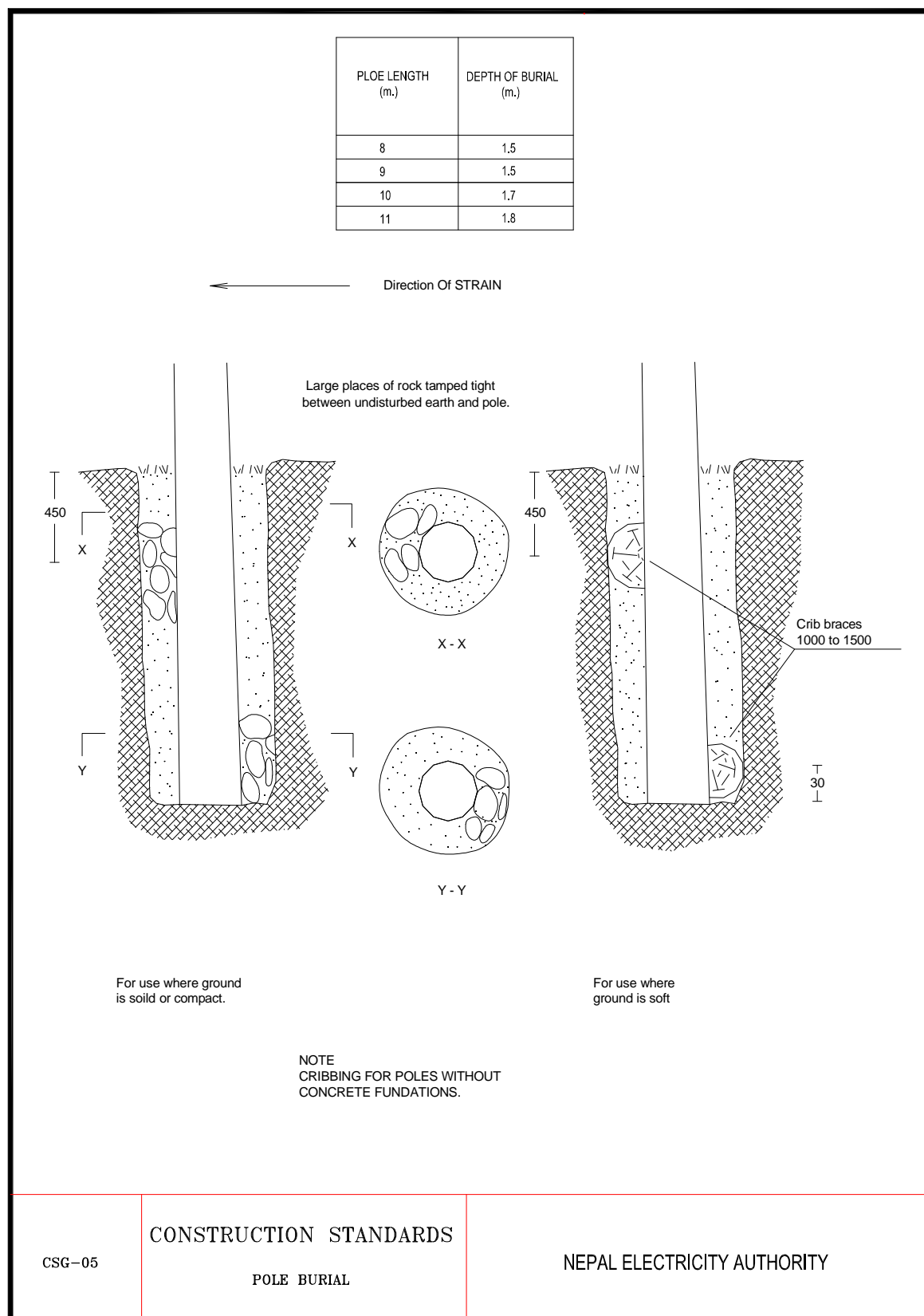


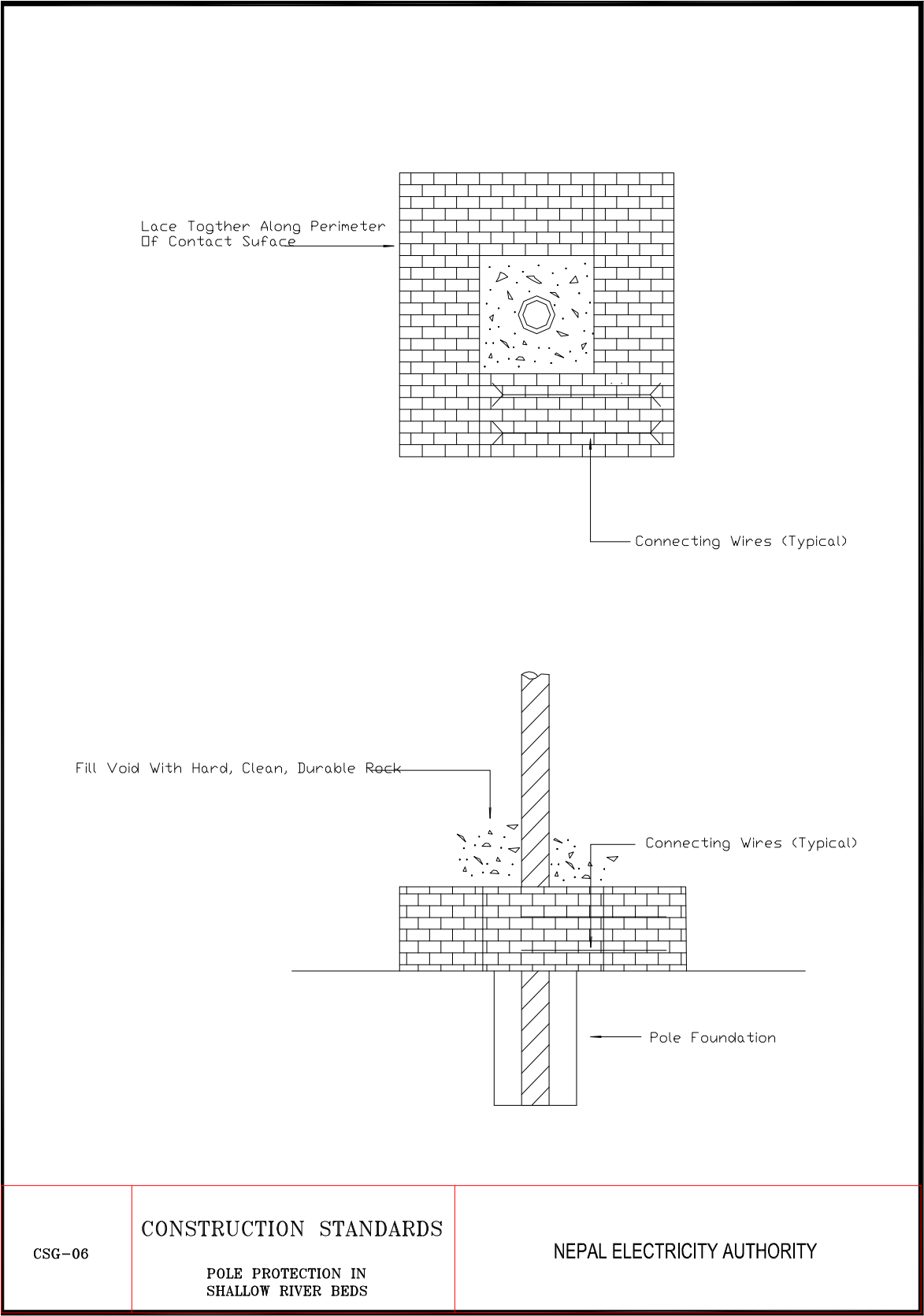
ANNEX L TYPICAL DRAWING	<b>LV Type 'E'</b> DEAD END ASSEMBLY	NEPAL ELECTRICITY AUTHORITY
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S.No.	QTY.	UNIT	MATERIAL
1	1	NOS	ANCHOR CLAMP
2	1 for PSC 0 for STP	NOS	PIGTAIL WITH HEXAGONAL NUTS AND WASHERS (16 X 203) MM
3	1 for PSC 0 for STP	NOS	EYE NUT
4	2 for STP 0 for PSC	NOS	POLE CLAMP WITH NUTS, BOLTS AND WASHERS (TC8)
5	5	NOS	INSULATED CABLE CAPS
6	1	NOS	POLE 9 METER
7	1	SET	LT STAY

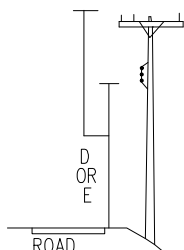
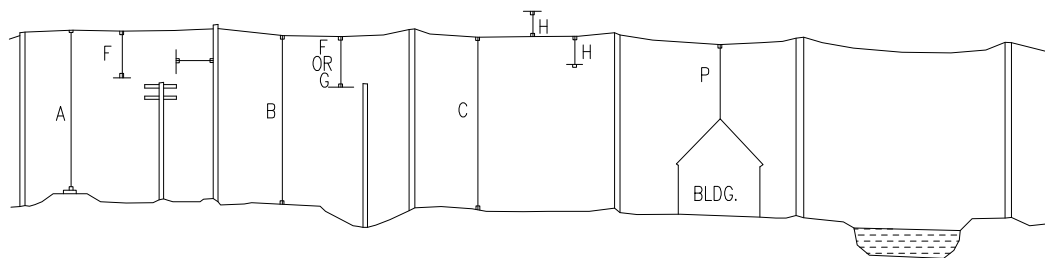
**CONSTRUCTION STANDARDS****LV TYPE - E (Single Anchor Dead End)****NEPAL ELECTRICITY AUTHORITY**





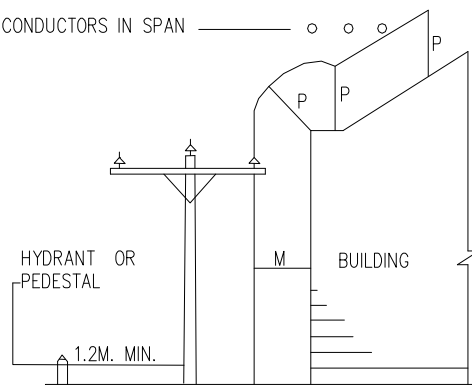


# CONDUCTOR CLEARANCE



POLES ADJACENT TO ROADS

CONDUCTORS IN SPAN



MINIMUM CLEARANCE FROM BUILDINGS

CROSSING OVER		VOLTAGE OF CIRCUIT CROSSING	METER
A	RAILROAD OR TURNPIKE	STAY & CABLE MESSENGER	7.10
		0 – 650 V.	7.10
		651 – 33,000 V.	7.60
B	ROAD, STREET, HIGHWAY OR LIMITED ACCESS HIGHWAY –	STAY & CABLE MESSENGER	5.80
		0 – 650 V.	5.80
		651 – 33,000 V.	6.10
C	AREAS ACCESSIBLE TO PEDESTRIANS ONLY	STAY & CABLE MESSENGER	4.60
		0 – 650 V.	4.60
		651 – 33,000	5.50
LINE ALONG SIDE OF			
D	MAIN HIGHWAYS STREETS OR ALLEYS	STAY & CABLE MESSENGER	5.50
		0 – 650 V.	5.50
		6581 – 33,000 V.	6.10
E	RURAL ROADS NO VEHICLE CROSSING UNDER	STAY & CABLE MESSENGER	4.60
		0 – 650 V.	4.60
		651 – 33,000 V.	6.00

LOCATION	VOLTAGE	CLEARANCE (METER)
M	0 – 11,000 V.	1.20
	11,000 – 33,000 V.	1.83
P	0 – 11,000 V.	2.44
	11,000 – 33,000 V.	3.65

CLEARANCE M ALSO SPECIFIED  
HORIZONTAL CLEARANCE FROM  
BALCONIES.

CSG-01

CONSTRUCTION STANDARDS

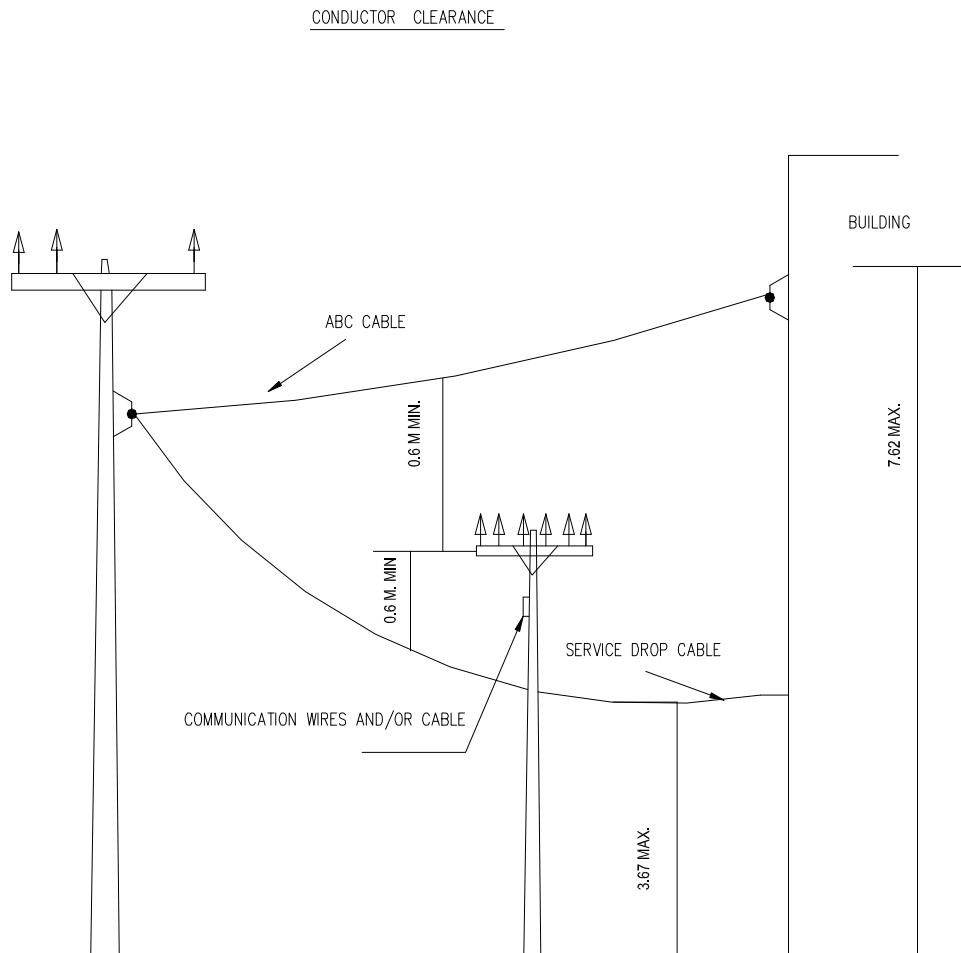
CONDUCTOR CLEARANCE

NEPAL ELECTRICITY AUTHORITY

CONDUCTORS AT LOWER LEVEL \ CONDUCTORS AT HIGHER LEVEL		SERVICE DROP 0 – 650 V	OPEN SUPPLY WIRES			STAYS AND SUPPLY CABLES ON GROUNDED MESSENGER
			0 – 650V	651 – 11000 V	33000 V	
F	COMMUNICATION WIRES	0.60 M.				
	COMMUNICATION CABLES AND MESSENGER	0.6 M. OVER 1.2 M. UNDER	1.38	2.15	—	0.60
G	SUPPLY CABLES ON EFFECTIVE GROUNDED MESSENGER	0.6 M. OVER 1.2 M. UNDER	0.60	0.60	—	0.60
H	OPEN SUPPLY 0 – 650 V.	—	1.30	1.80	2.70	0.60
	WIRES 651 – 11,000 V.	—	—	1.20	—	1.20
GUYS SERVICE DROPS 0 – 650 V.		0.60	0.60	1.20	—	—

— VOLTAGE SHOWN ARE PHASE TO GROUND VALUES.

CSG-02	CONSTRUCTION STANDARDS CONDUCTOR CLEARANCE	NEPAL ELECTRICITY AUTHORITY
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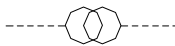
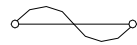
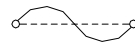


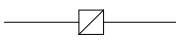
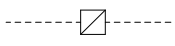
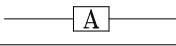
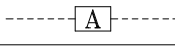


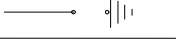
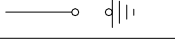





**SERVICE DROP:** Install Service over communication facilities where practical and attached to pole when available; otherwise cross under communication facilities; with proper clearance.

SERVICE DROP (0-600 V) Crossing Over	CLEARANCE
DRIVE WAY TO RESIDENCE, GARAGE, OR OVER PARKING LOT EXCLUDING TRACKS IN URBAN AREA	3.67 M
DRIVE WAY AND COMMERCIAL PARKING LOT OR AREA SUBJECT TO TRUCK TRAFFIC	4.57 M

CSG-03

CONSTRUCTION STANDARDS  
CONDUCTOR CLEARANCE

NEPAL ELECTRICITY AUTHORITY

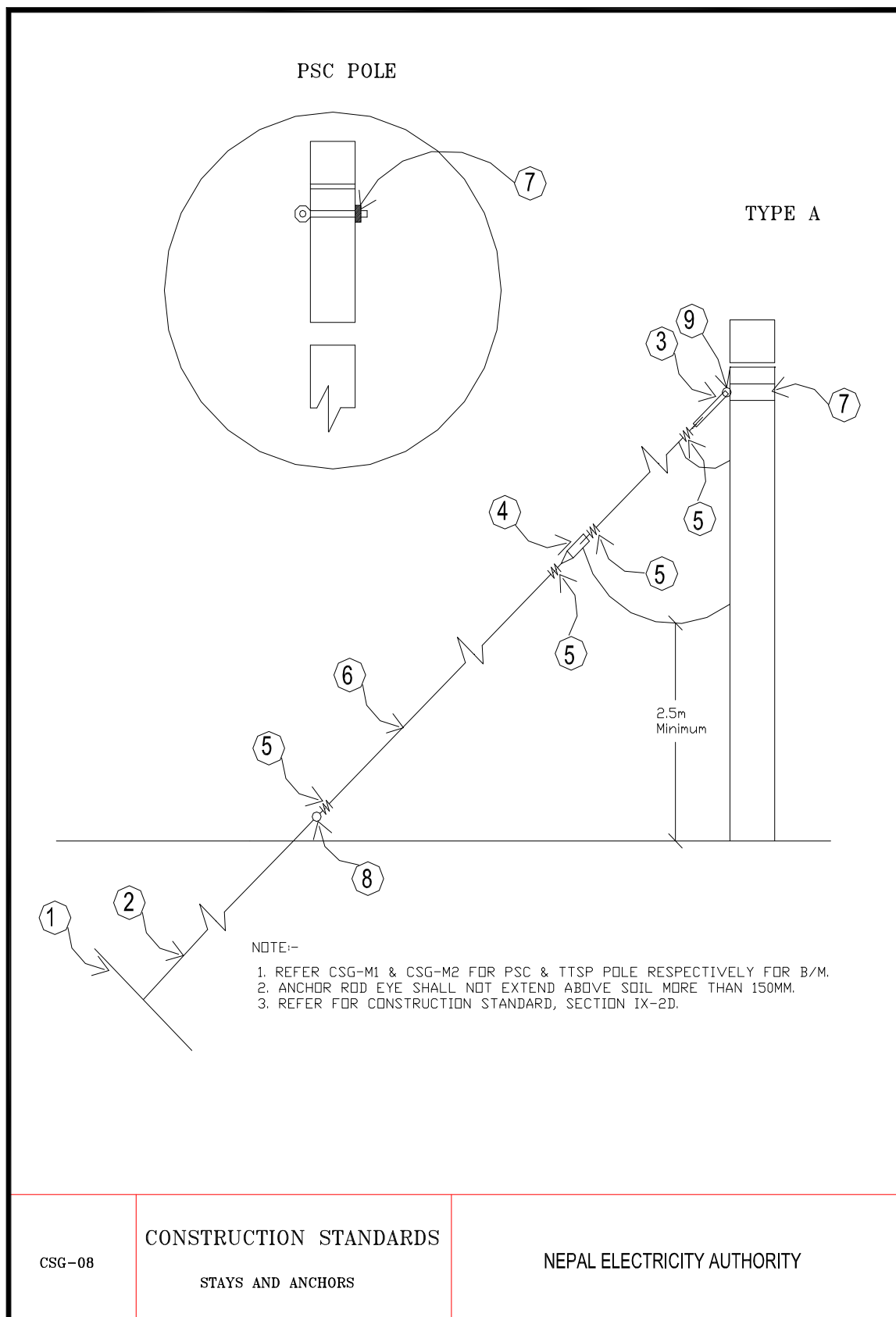
SN	ELECTRIC SYMBOLS	EXISTING	PROPOSED
1	Transformer		
2	Fuse Cutout		
3	Disconnecting Switch		
4	Load Break Switch		
5	Auto Reclosure		
6	Substation		
7	Lighting Arrester		
8	Pole Telescopic with Stay		
9	Pole P.S.C. with Stay		
10	Tapping Point		

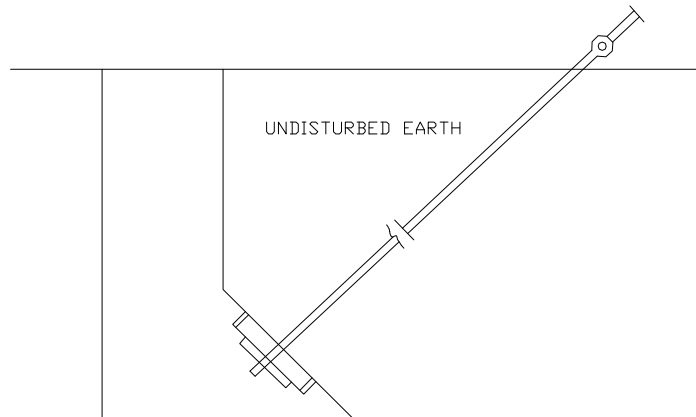
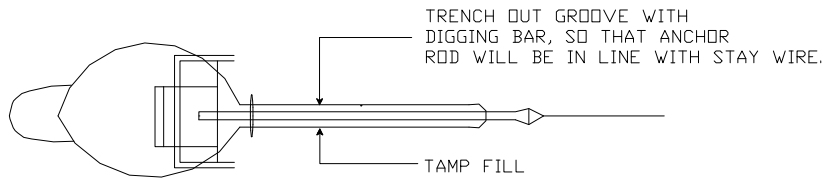
CSG-04

CONSTRUCTION STANDARDS

ELECTRICAL SYMBOLS

NEPAL ELECTRICITY AUTHORITY





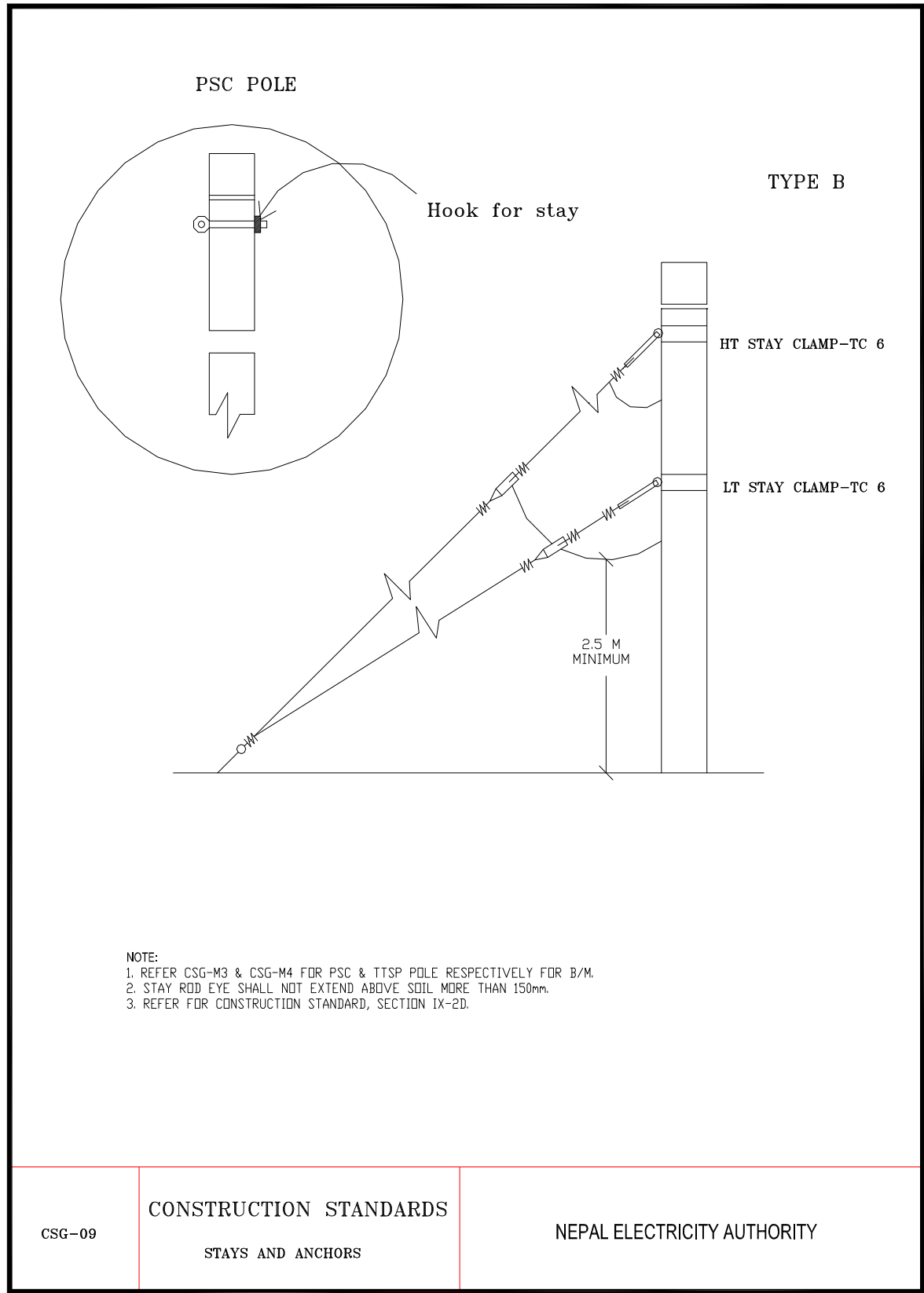
1. BACKFILL SHALL BE THOROUGHLY TAMPED.
2. BACKFILL FOR ANCHORS PLACED IN SOFT OR UNSTABLE SOIL SHALL BE 50MM GRAVEL PLACED TO DEPTH OF 1000 MM ABOVE ANCHOR PLATE.

CSG-07	CONSTRUCTION STANDARDS STAYS AND ANCHORS	NEPAL ELECTRICITY AUTHORITY
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S.No.	MATERIAL (HT-STAY)	QTY.	UNIT	MATERIAL (LT-STAY)	QTY
1	HT STAY SET (600 x 600 MM PLATE AND ROD)	1	NOS	LT STAY SET (300 X 300 MM PLATE AND ROD)	1
2	HT TURN BUCKLE	1	NOS	LT TURN BUCKLE	1
3	HT THIMBLES	1	NOS	LT THIMBLES	1
4	POLE CLAMP(TC6)	1	NOS	POLE CLAMP(TC8)	0
5	HT STAY INSULATOR	1	NOS	STAY INSULATOR	1
6	PREFORM TIE FOR STAY WIRE 7/8 SWG	4	NOS	PREFORM TIE FOR STAY WIRE 7/12 SWG	4
7	7/8" SWG STAY WIRE	12	M	7/12" SWG STAY WIRE	10
8	HT EYE BOLT	0	NOS	LT EYE BOLT	0

**CONSTRUCTION STANDARDS  
HT AND LT - SINGLE STAY**

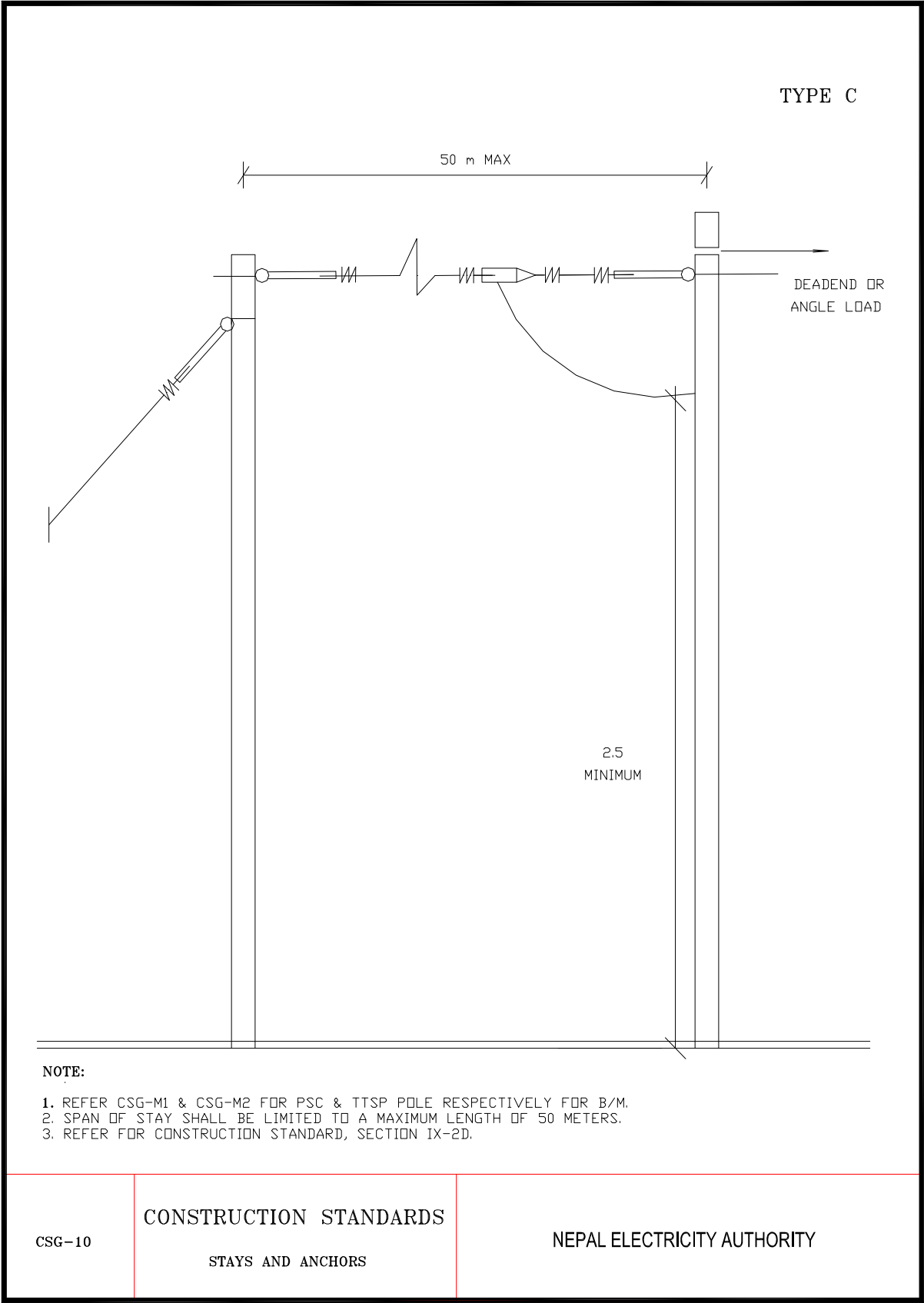
**NEPAL ELECTRICITY AUTHORITY**



S.No.	MATERIAL (HT-STAY)	QTY.	UNIT	MATERIAL (LT-STAY)	QTY
1	HT STAY SET (600 x 600 MM PLATE AND ROD)	1	NOS	LT STAY SET (300 X 300 MM PLATE AND ROD)	1
2	HT TURN BUCKLE	2	NOS	LT TURN BUCKLE	2
3	HT THIMBLES	2	NOS	LT THIMBLES	2
4	POLE CLAMP(TC6)	2	NOS	POLE CLAMP(TC8)	1
5	HT STAY INSULATOR	2	NOS	STAY INSULATOR	2
6	PREFORM TIE FOR STAY WIRE 7/8 SWG	8	NOS	PREFORM TIE FOR STAY WIRE 7/12 SWG	8
7	7/8" SWG STAY WIRE	24	M	7/12" SWG STAY WIRE	20
8	HT EYE BOLT	0	NOS	LT EYE BOLT	0

**CONSTRUCTION STANDARDS  
HT AND LT – DOUBLE STAY**

**NEPAL ELECTRICITY AUTHORITY**



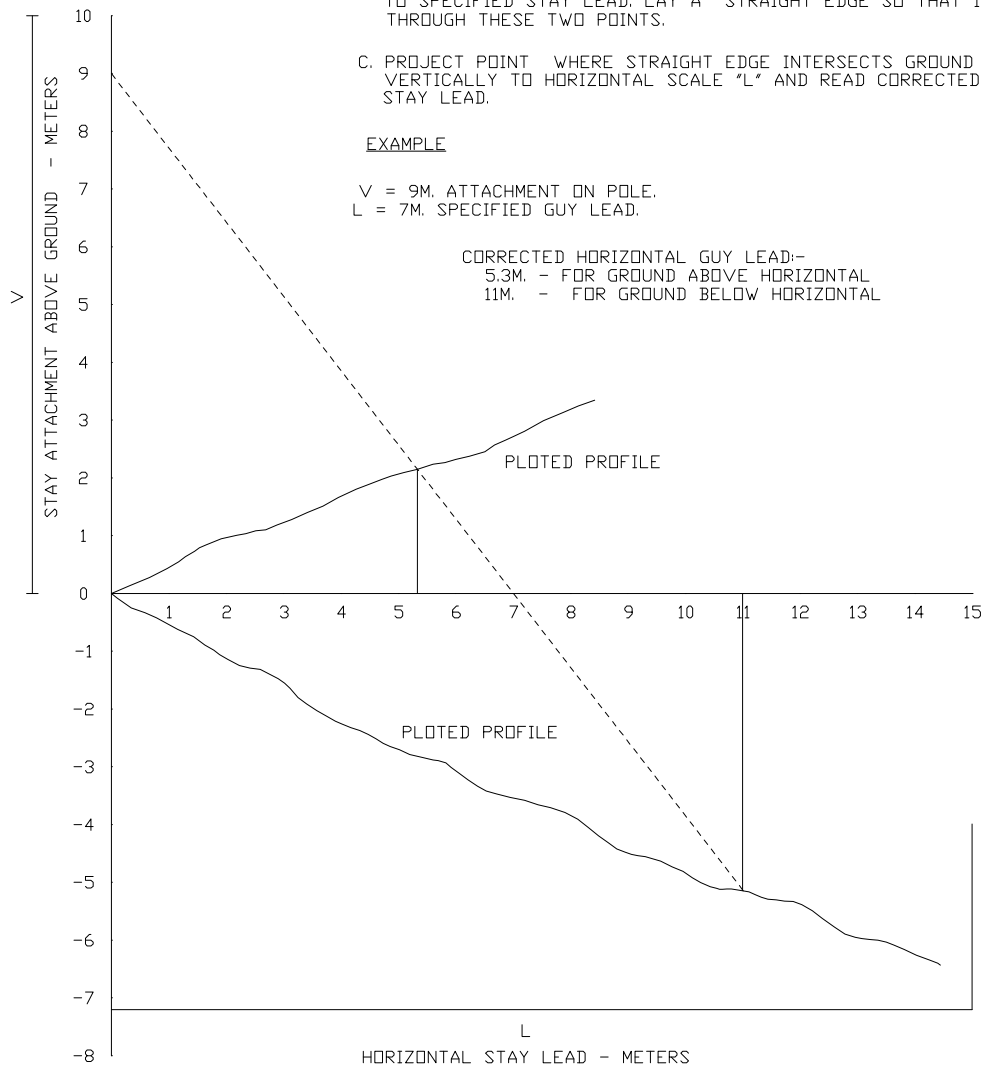
NOTES

- A. PLOT APPROXIMATE GROUND LINE PROFILE UNDER PROPOSED SAY.
- B. SELECT A POINT ON VERTICAL SCALE "V" CORRESPONDING TO GUY ATTACHMENT ON POLE, SELECT A POINT ON HORIZONTAL SCALE "L" CORRESPONDING TO SPECIFIED STAY LEAD. LAY A STRAIGHT EDGE SO THAT IT PASSES THROUGH THESE TWO POINTS.
- C. PROJECT POINT WHERE STRAIGHT EDGE INTERSECTS GROUND LINE PROFILE VERTICALLY TO HORIZONTAL SCALE "L" AND READ CORRECTED HORIZONTAL STAY LEAD.

EXAMPLE

V = 9M. ATTACHMENT ON POLE.  
L = 7M. SPECIFIED GUY LEAD.

CORRECTED HORIZONTAL GUY LEAD:-  
5.3M. - FOR GROUND ABOVE HORIZONTAL  
11M. - FOR GROUND BELOW HORIZONTAL



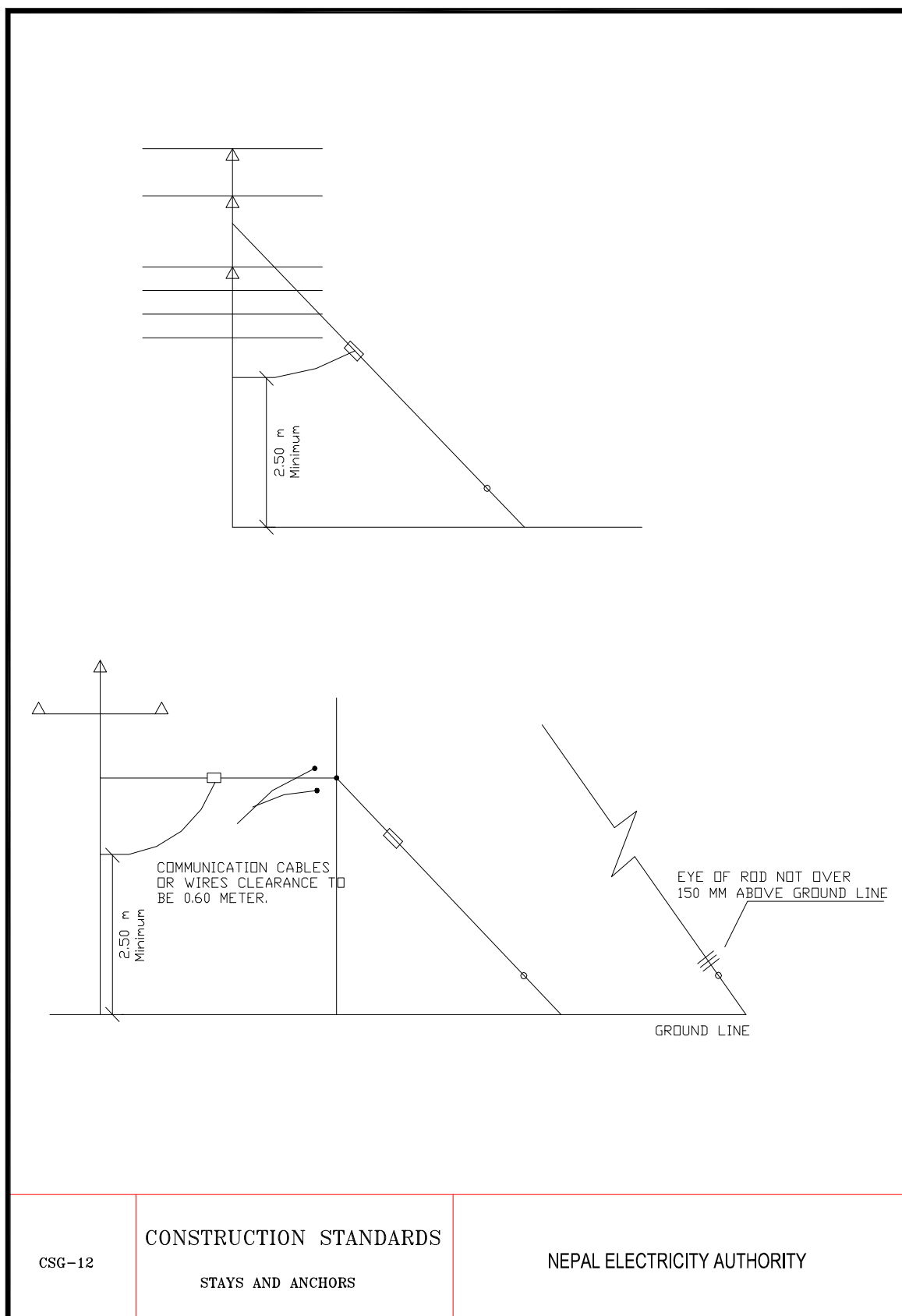
CSG-11

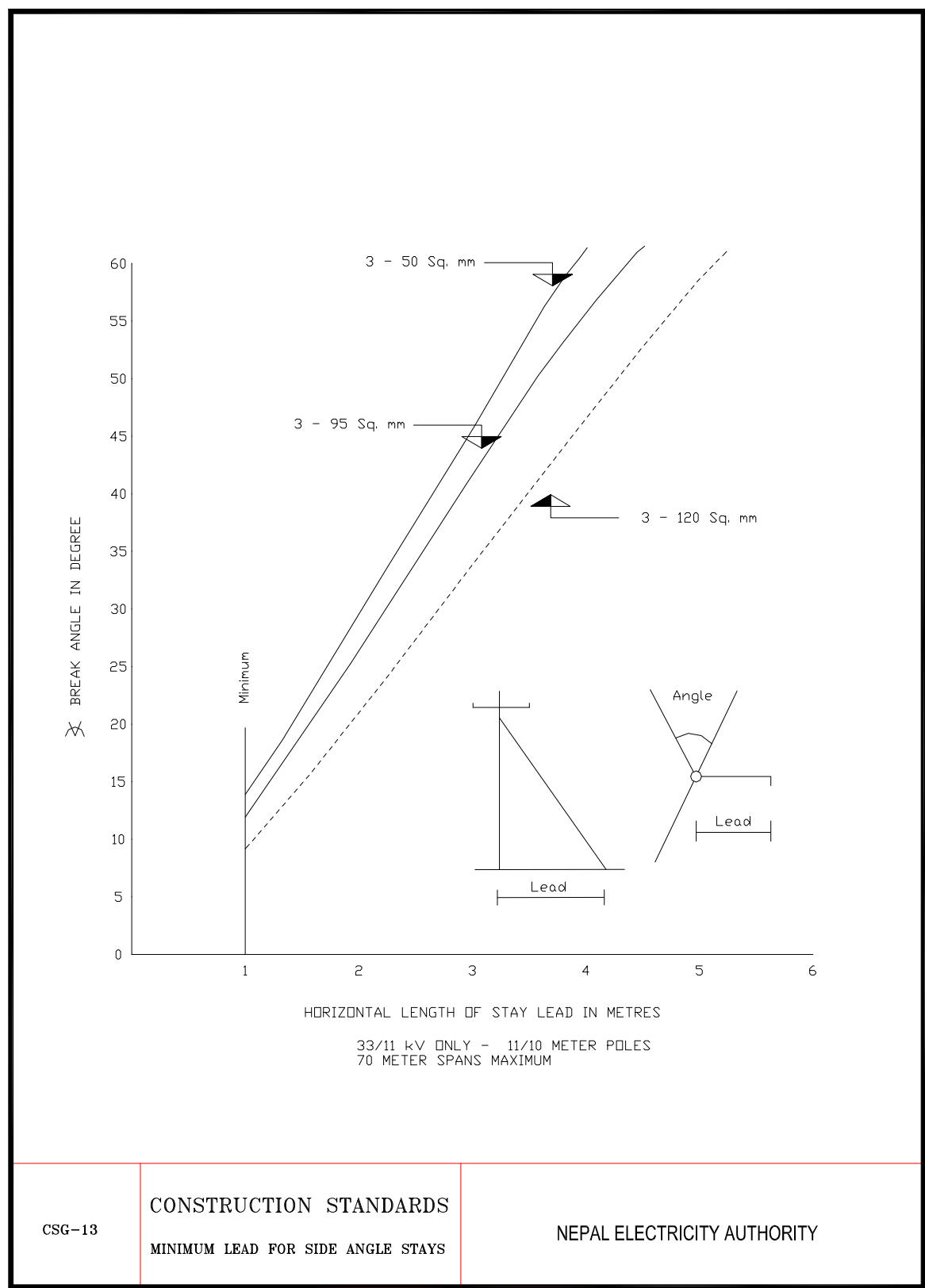
CONSTRUCTION STANDARDS

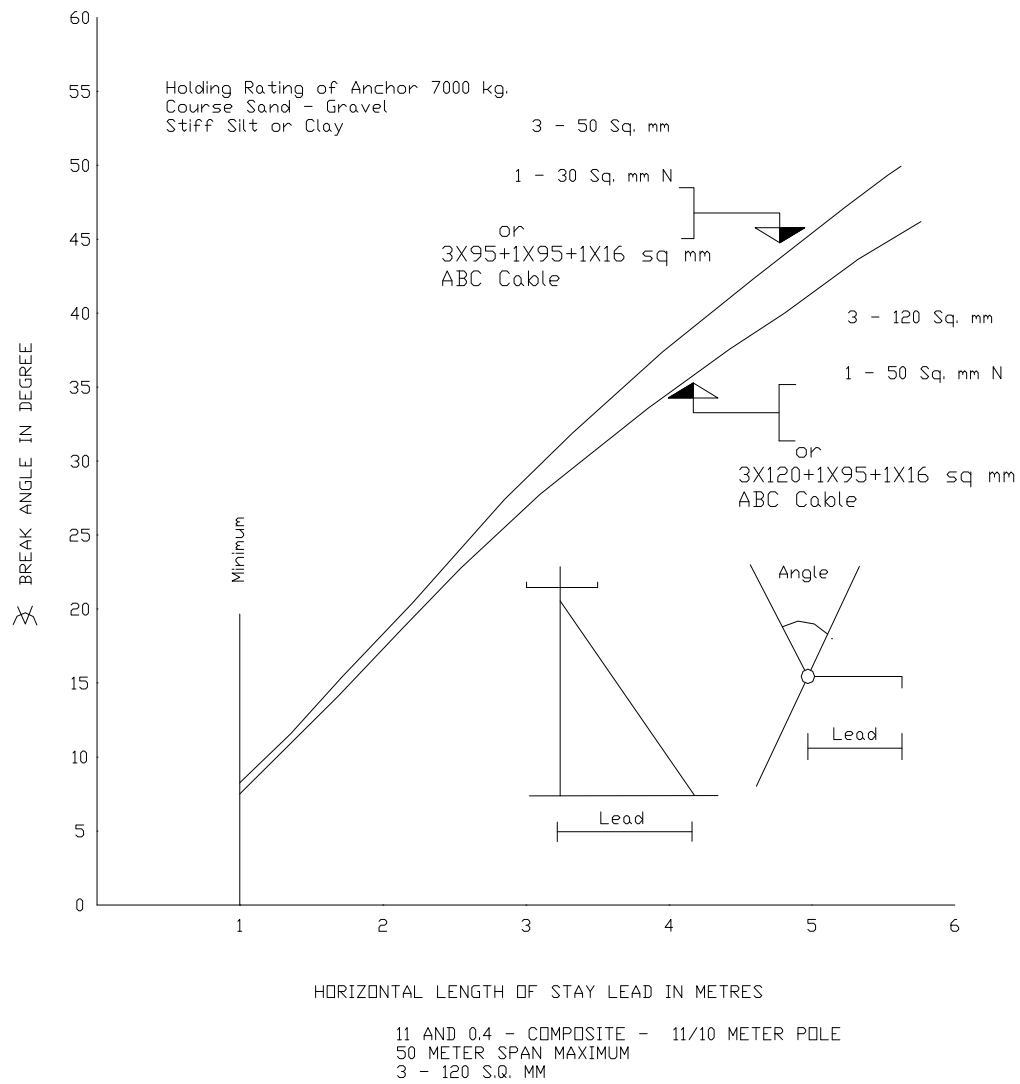
STAYS AND ANCHORS

NEPAL ELECTRICITY AUTHORITY

S.No.	MATERIAL (HT-STAY)	QTY.	UNIT	MATERIAL (LT-STAY)	QTY
1	HT STAY SET (600 x 600 MM PLATE AND ROD)	1	NOS	LT STAY SET (300 X 300 MM PLATE AND ROD)	1
2	HT TURN BUCKLE	2	NOS	LT TURN BUCKLE	2
3	HT THIMBLES	1	NOS	LT THIMBLES	1
4	POLE CLAMP(TC6)	1	NOS	POLE CLAMP(TC8)	1
5	POLE CLAMP(TC8)	1	NOS		
6	HT STAY INSULATOR	2	NOS	STAY INSULATOR	2
7	PREFORM TIE FOR STAY WIRE 7/8 SWG	8	NOS	PREFORM TIE FOR STAY WIRE 7/12 SWG	8
8	7/8" SWG STAY WIRE	25	M	7/12" SWG STAY WIRE	20
9	HT EYE BOLT	0	NOS	LT EYE BOLT	0
10	POLE 11M	1	NOS	POLE 9M	1
CONSTRUCTION STANDARDS HT AND LT – FLYING STAY			NEPAL ELECTRICITY AUTHORITY		



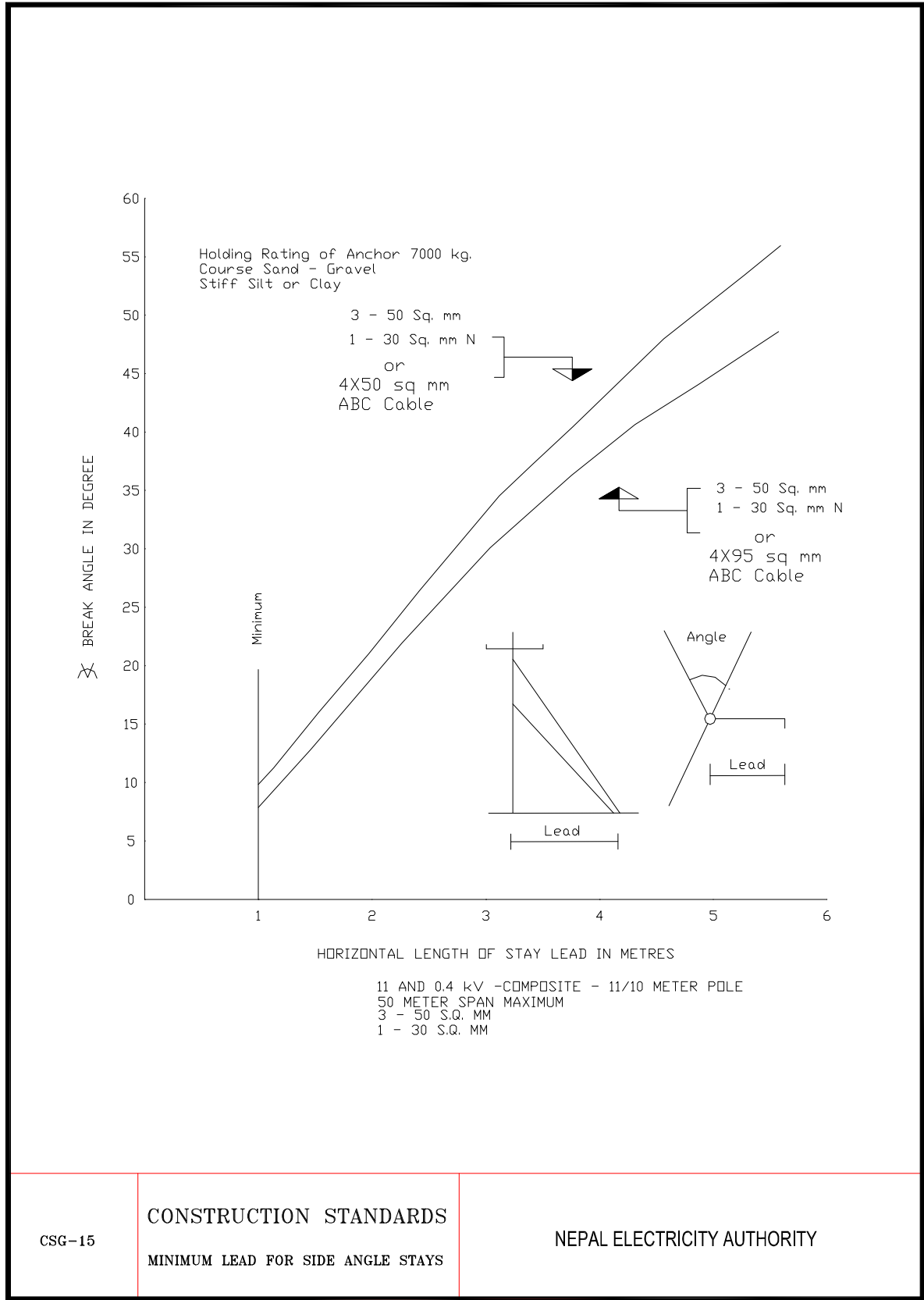


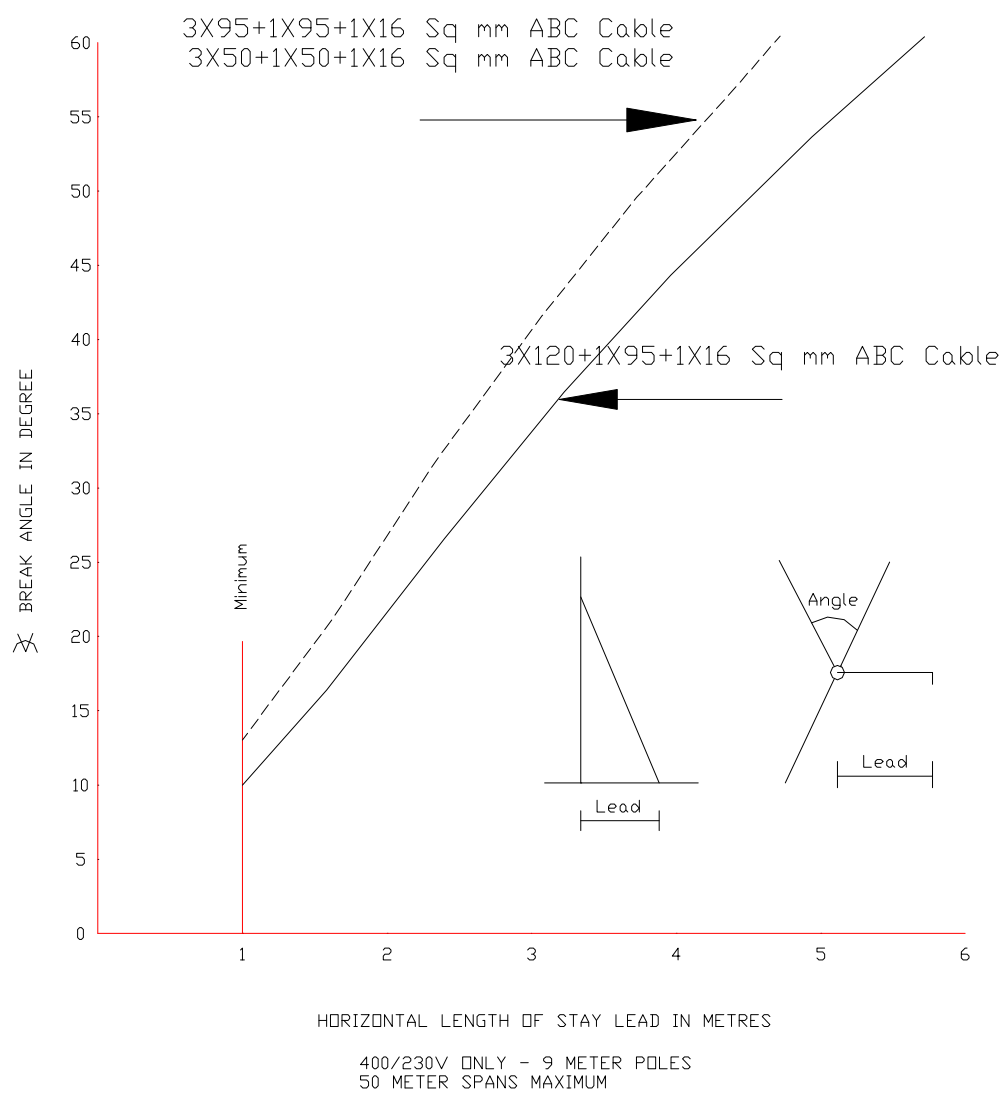


CSG-14

CONSTRUCTION STANDARDS  
MINIMUM LEAD FOR SIDE ANGLE STAYS

NEPAL ELECTRICITY AUTHORITY



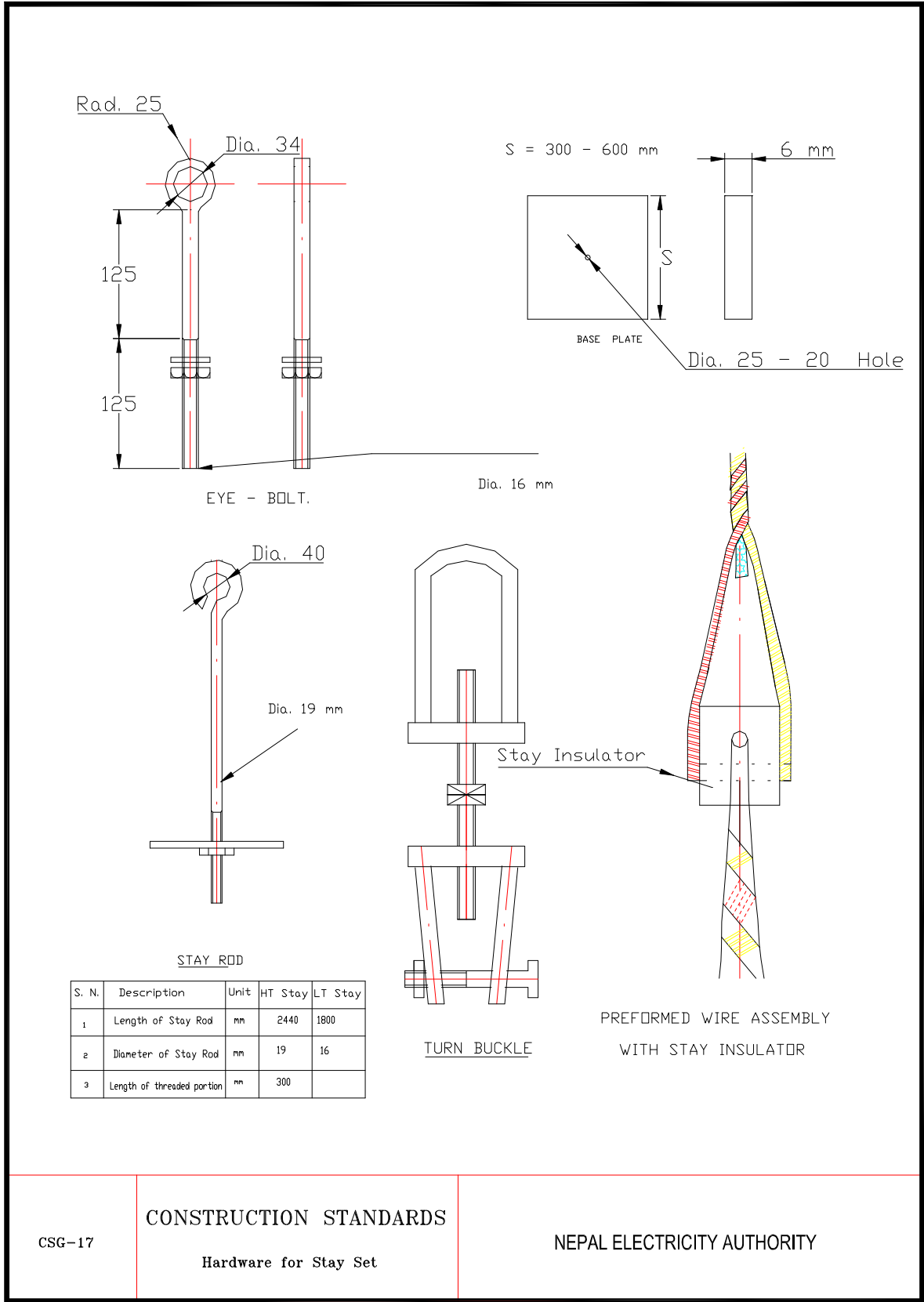


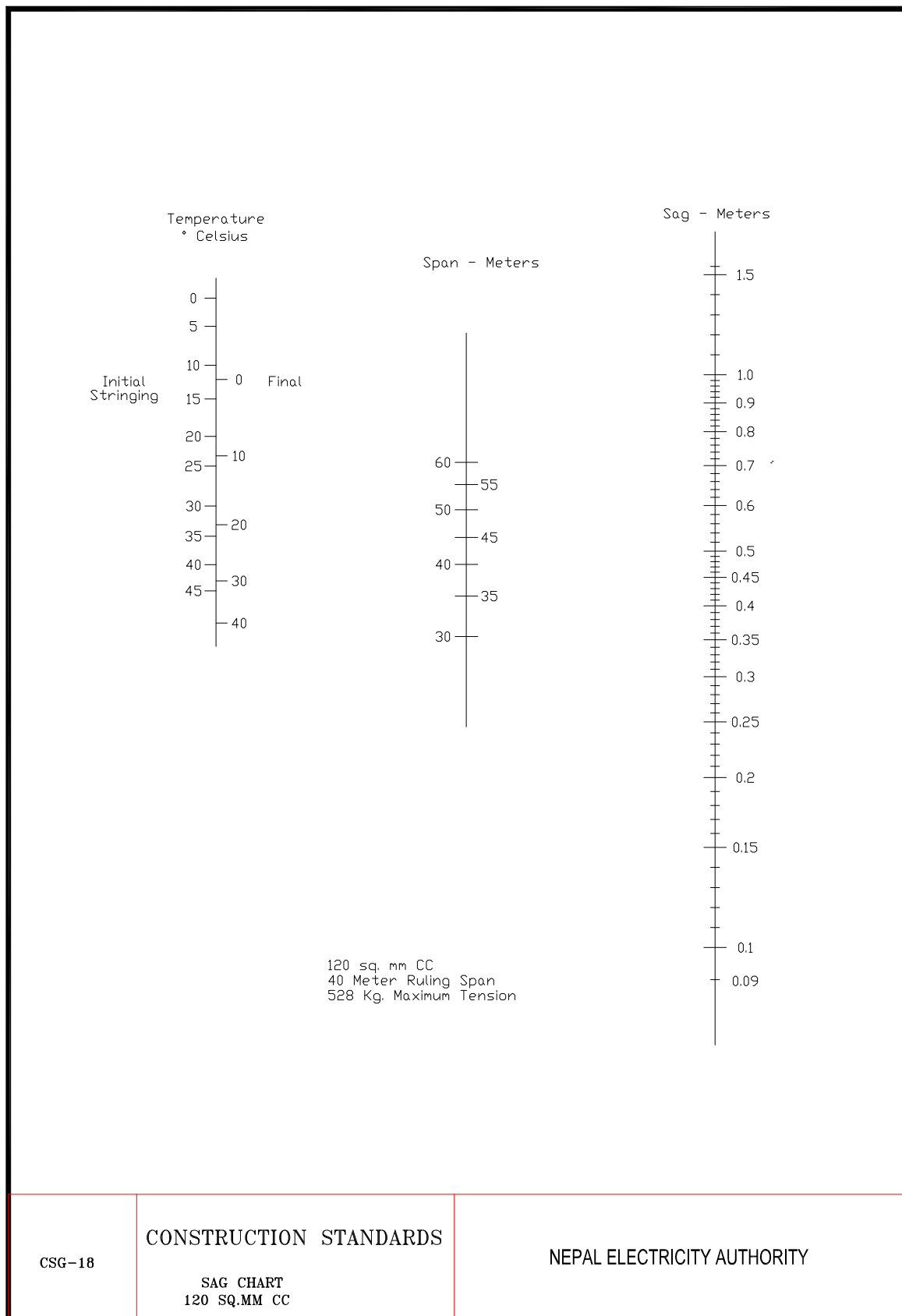
CSG-16

## CONSTRUCTION STANDARDS

MINIMUM LEAD FOR SIDE ANGLE STAYS

NEPAL ELECTRICITY AUTHORITY



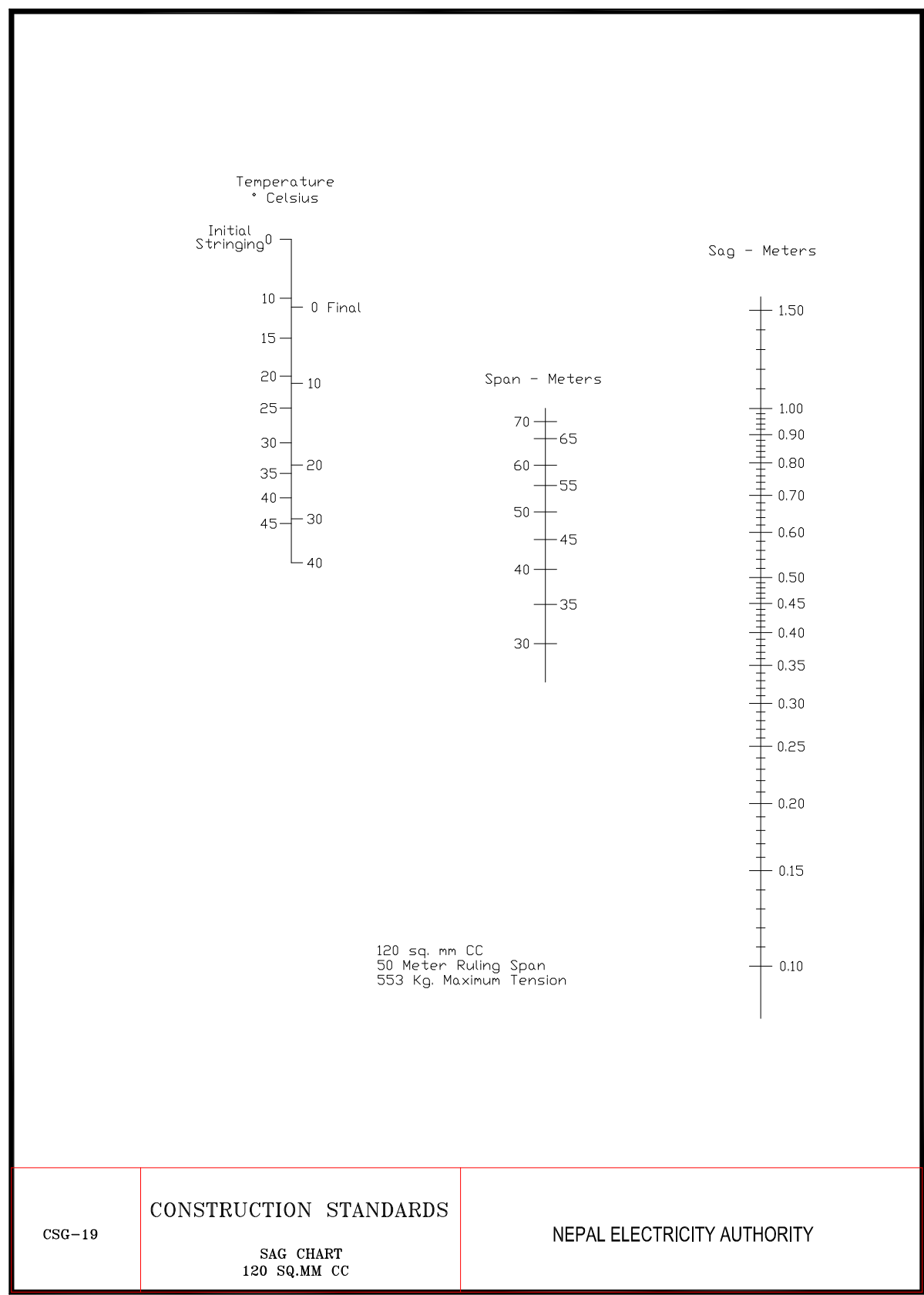


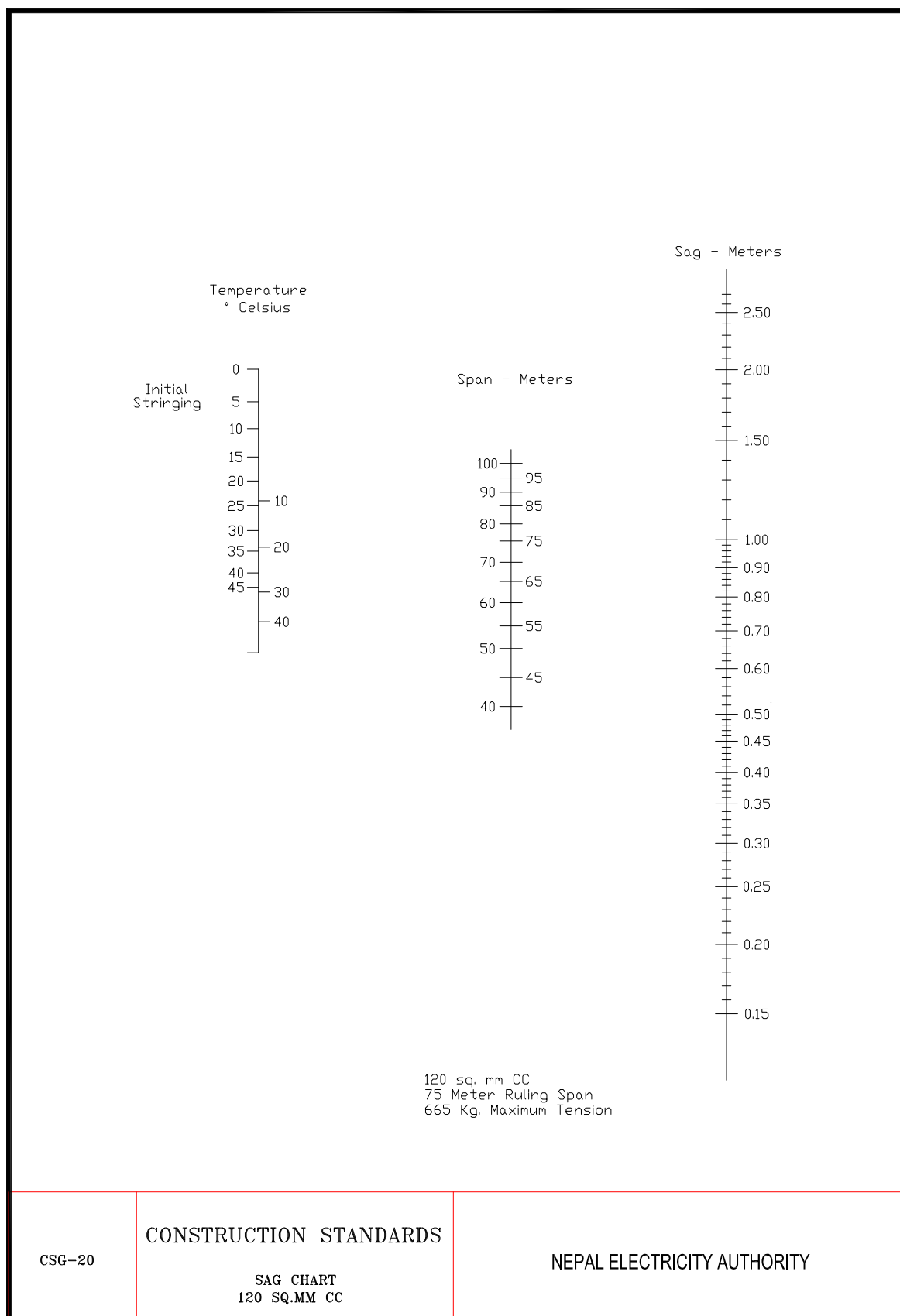
CSG-18

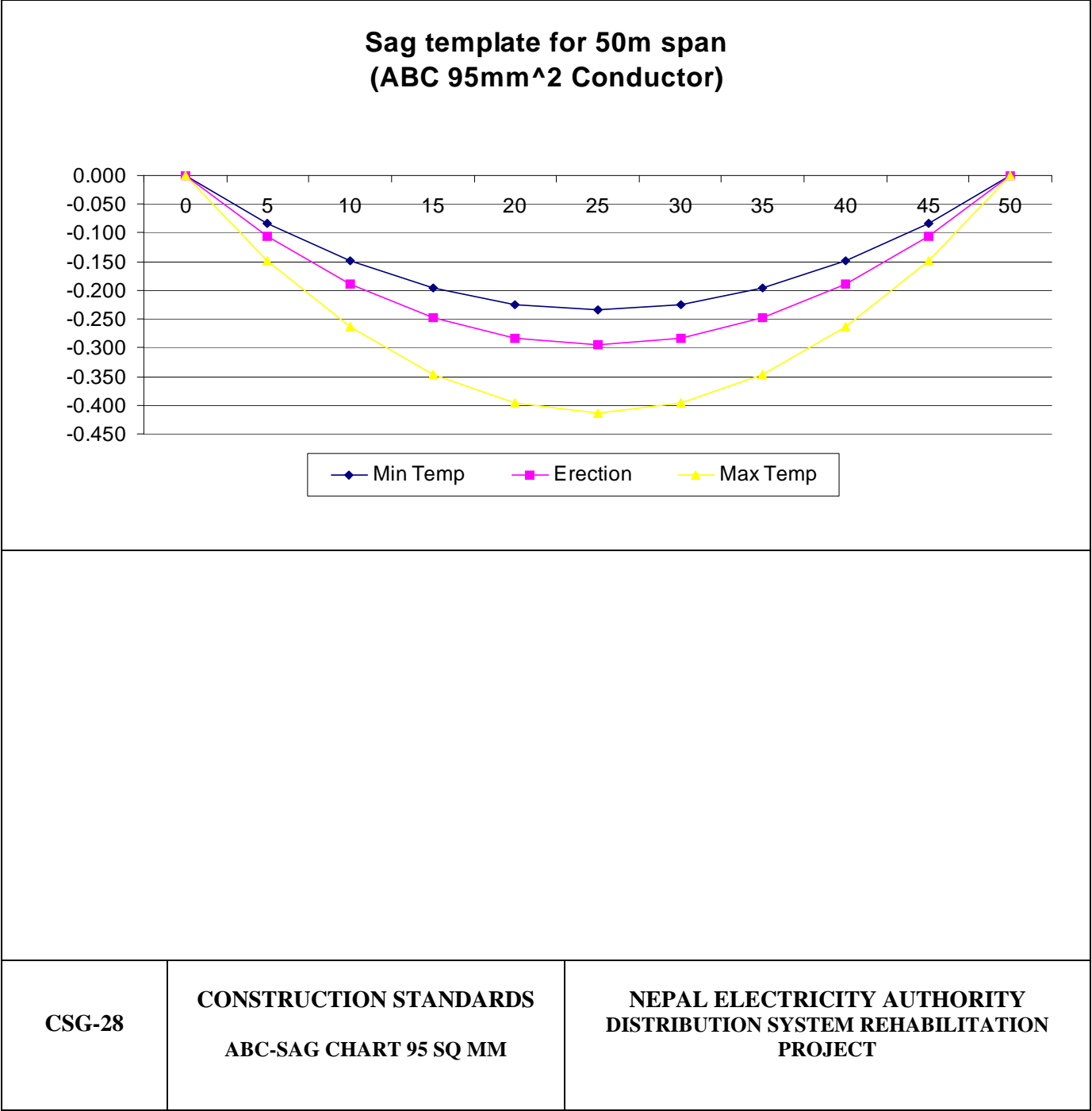
CONSTRUCTION STANDARDS

NEPAL ELECTRICITY AUTHORITY

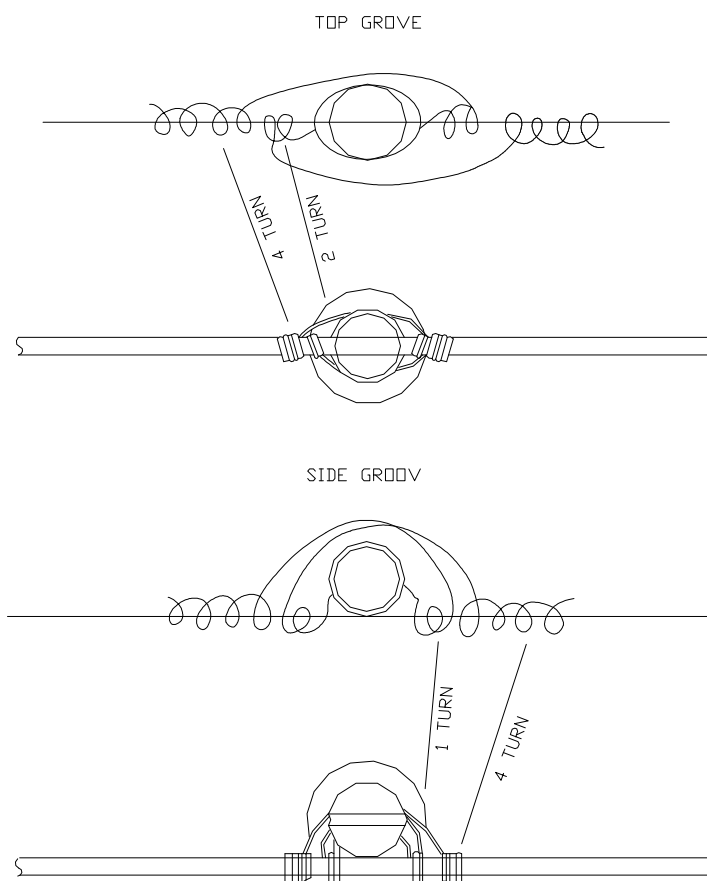
SAG CHART  
120 SQ.MM CC







## JUMPER TIES



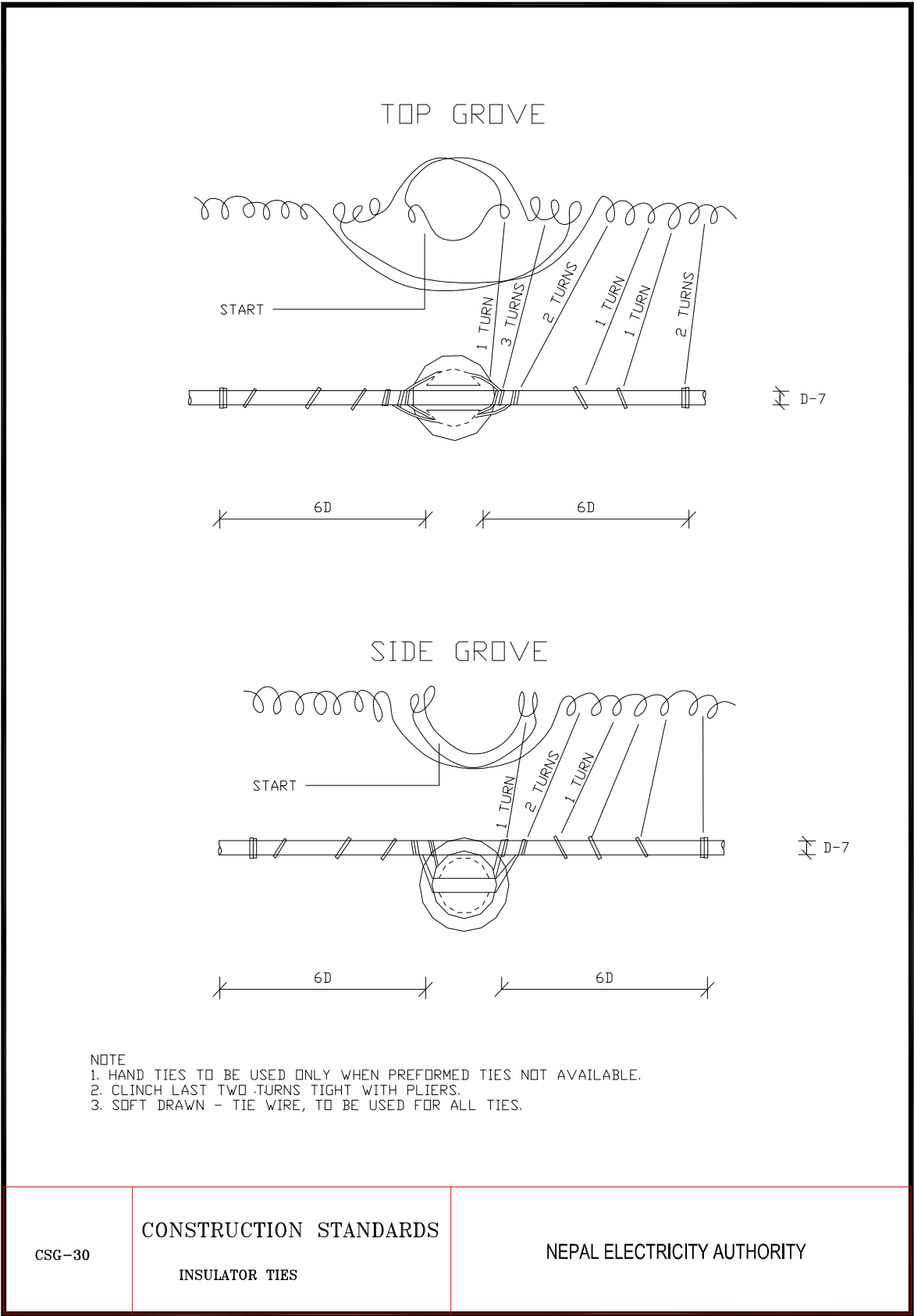
### NOTES

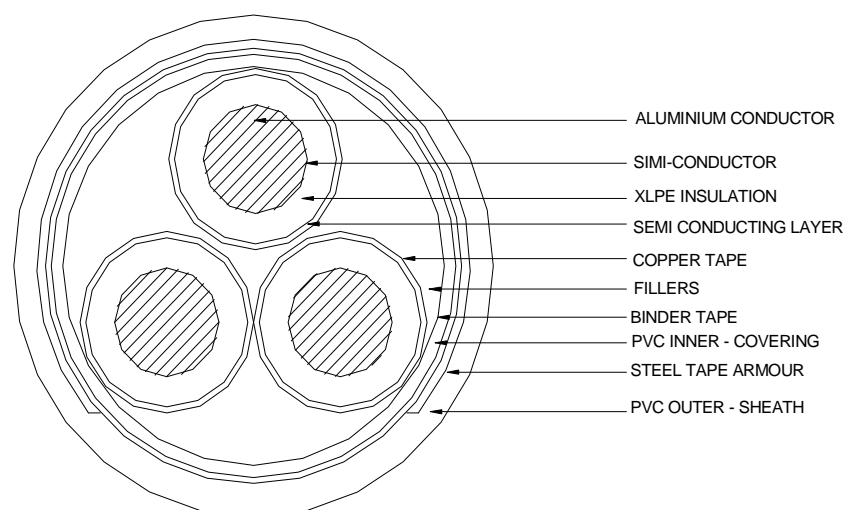
1. TIE WIRE ASSEMBLY SHOULD BE AS TIGHT AS CAN BE WRAPPED.
2. TURNS MAY BE IN EITHER DIRECTION, AS LONG AS ONE-HALF THE TURNS OPPOSE THE OTHER HALF TO PREVENT LOOSENING OF THE TIE.
3. USE ONLY FOR SECURING JUMPERS ON STRUCTURES.

CSG-29

CONSTRUCTION STANDARDS  
INSULATOR TIES

NEPAL ELECTRICITY AUTHORITY





CSG-33

# CONSTRUCTION STANDARDS

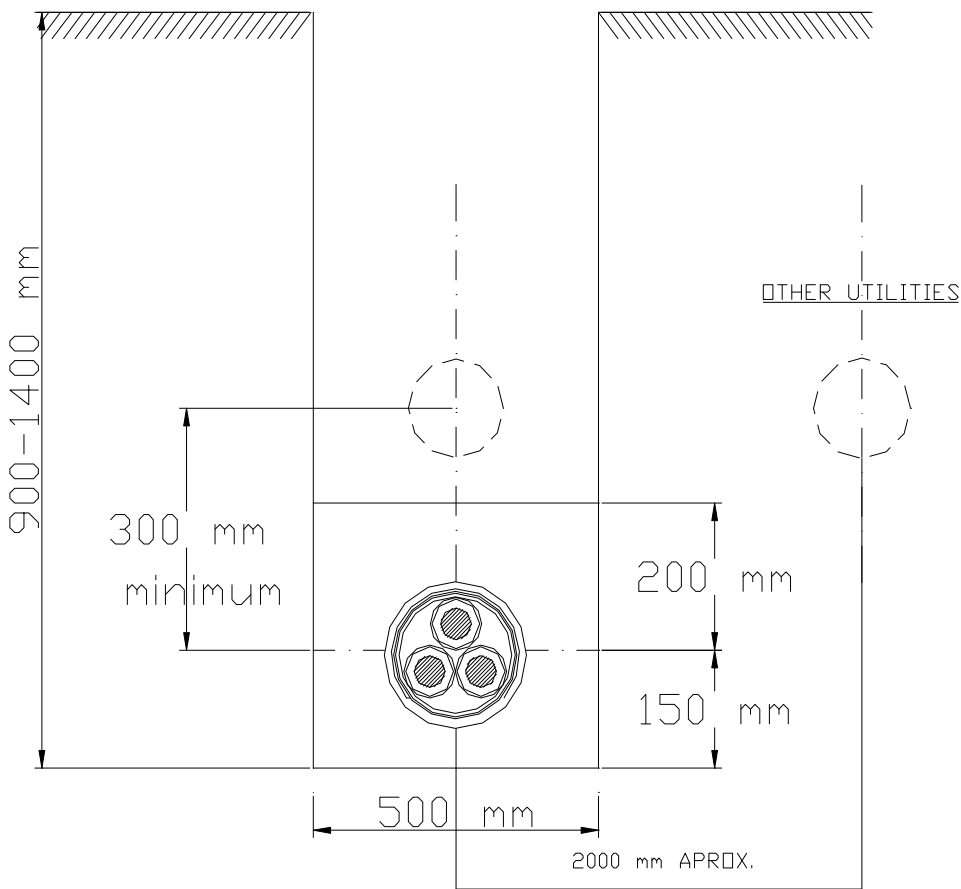
300 SQ. MM XLPE CABLE-CROSS SECTION

NEPAL ELECTRICITY AUTHORITY

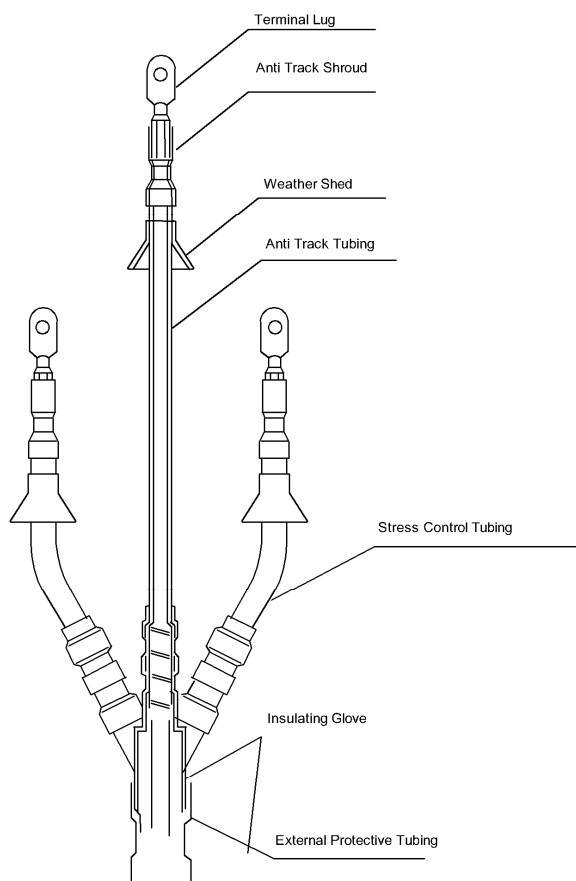
UNDERGROUND CABLE

CONSTRUCTION NOTES

CABLES SHALL BE LAID LOOSELY IN THE TRENCH AND IN PARALLEL.  
CABLE SHALL NOT CROSS OR LAY ON TOP OF ONE ANOTHER.  
BACKFILL SHALL BE CLEAN AND FREE OF STONES AND SHARP OBJECTS 150 MM BELOW AND 200 MM ABOVE THE CABLE.  
IF TELEPHONE IS PERMITTED IN THE SAME TRENCH IT MUST MAINTAIN A SEPARATION OF 300 MM ABOVE THE CABLE.  
OTHER UTILITIES SUCH AS GAS, WATER, SEWER ETC, IF PARALLEL TO DIRECT BURIED ELECTRIC CABLES, SHOULD MAINTAIN A HORIZONTAL SEPARATION OF 2000 MM.



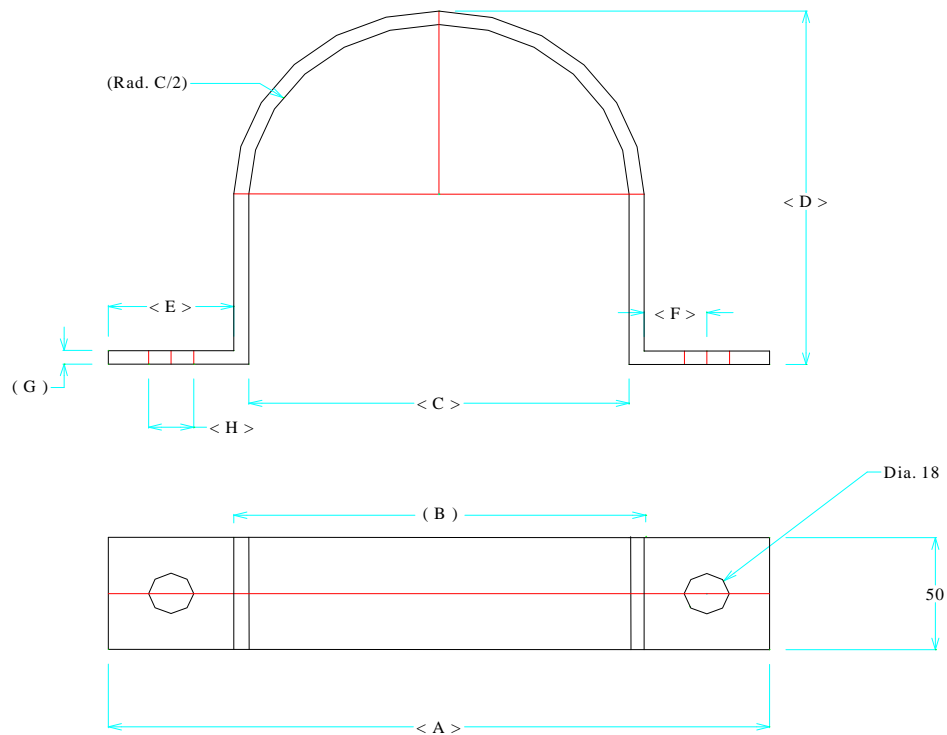
CSG-34	<p>CONSTRUCTION STANDARDS</p> <p>11 kV XLPE UNDERGROUND CABLE LAYING GENERAL INSTRUCTION</p>	NEPAL ELECTRICITY AUTHORITY
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Drawing  
CS11-LM-10

**Outdoor Heat Shrinkable  
Cable Termination Kit**

NEPAL ELECTRICITY AUTHORITY

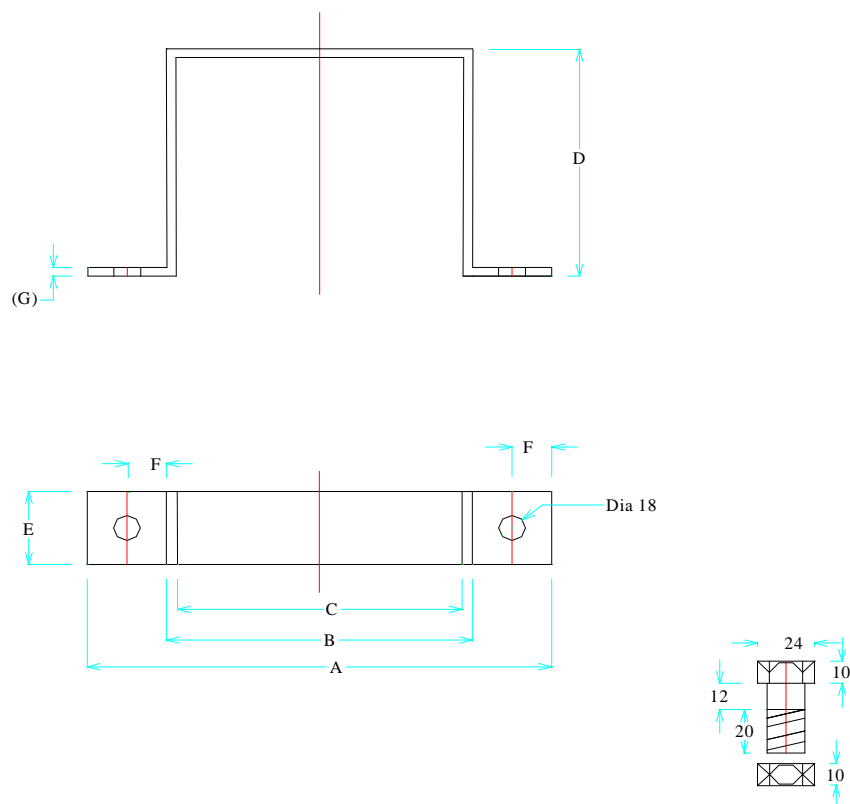


Type	Unit	A	B	C	D	E	F	G	H	Remarks
TC1	mm	285	185	173	179	50	25	6	18	
TC2	mm	297	197	185	191	50	25	6	18	
TC3	mm	307	207	195	201	50	25	6	18	
TC7	mm	334	234	222	228	50	25	6	18	
TC4	mm	347	247	235	241	50	25	6	18	
TC5	mm	397	297	285	291	50	25	6	18	

Note :- Dimensions are subject to approval prior to manufacture.

#### NEPAL ELETRICITY AUTHORITY

All Dimension in mm	Semicircular Clamp for Tubular pole  DWG. 1H	Drawn by		
		Checked by		
		Approved by		

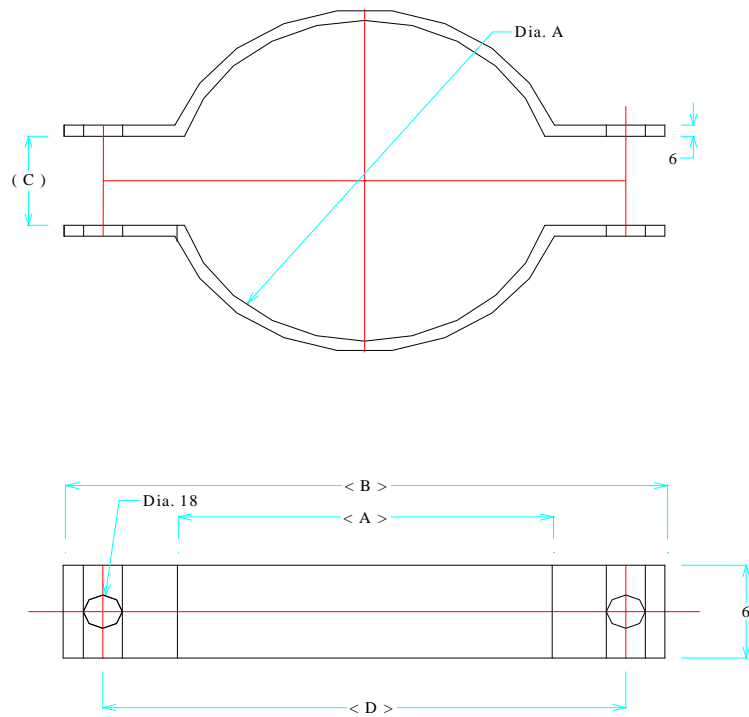


Type	Unit	A	B	C	D	E	F	G	Remarks
PC1	mm	295	195	183	150	50	25	6	
PC2	mm	306	206	194	150	50	25	6	
PC3	mm	262	162	150	204	50	25	6	
PC4	mm	316	216	204	150	50	25	6	
PC5	mm	354	254	242	150	50	25	6	
PC6	mm	402	302	290	150	50	25	6	

Note :- Dimensions are subject to approval prior to manufacture.

#### NEPAL ELETRICITY AUTHORITY

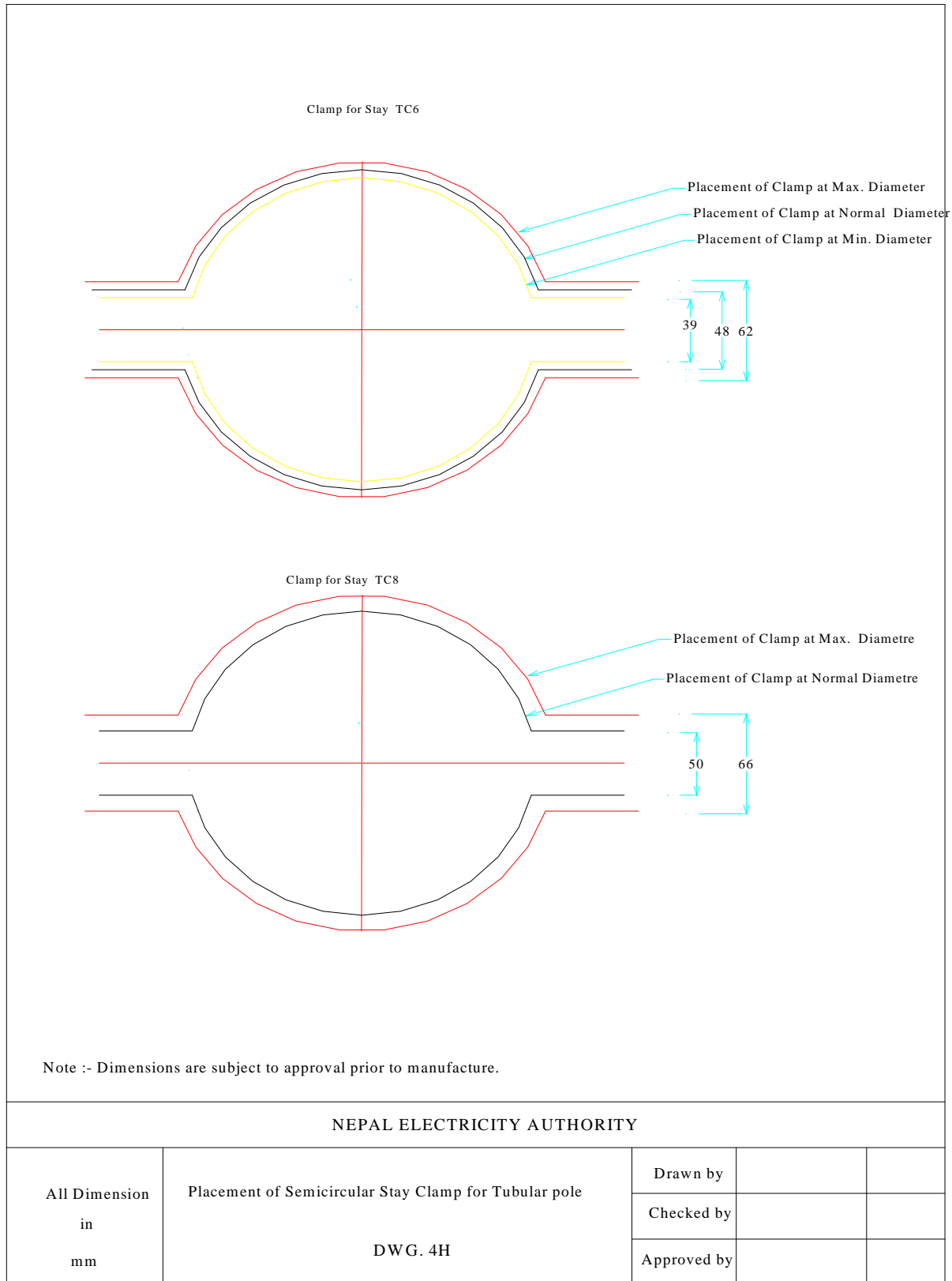
All Dimension in mm	Rectangular Clamp for PSC pole  DWG. 2H	Drawn by		
		Checked by		
		Approved by		



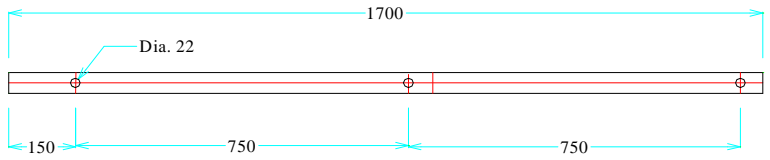
Type	Unit	A	B	C	D	Remarks
TC6	mm	200	302	50	268	
TC8	mm	155	257	50	223	

Note :- Dimensions are subject to approval prior to manufacture.

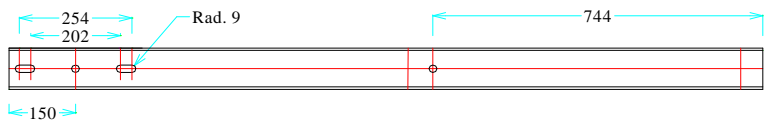
NEPAL ELECTRICITY AUTHORITY				
All Dimension in mm	Semicircular Stay Clamp for Tubular Pole  DWG. 3H	Drawn by		
		Checked by		
		Approved by		



Off Set Cross Arm for 11 kV (100 x 50 x 6.4 x 1700 mm )



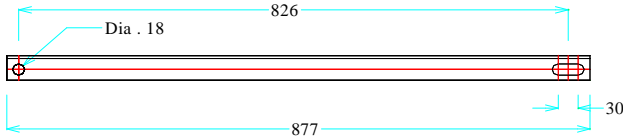
Top View



Front View

Bracing Angle For 11kV Off Set

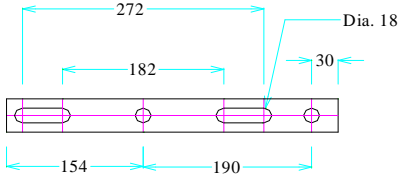
( 877 x 40 x 40 x 5 mm )



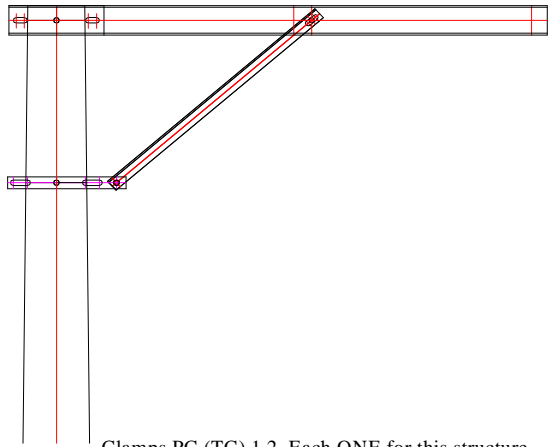
Front View

Flat Brace for 11kV Off Set

( 374 x 40 x 6 mm )



Front View



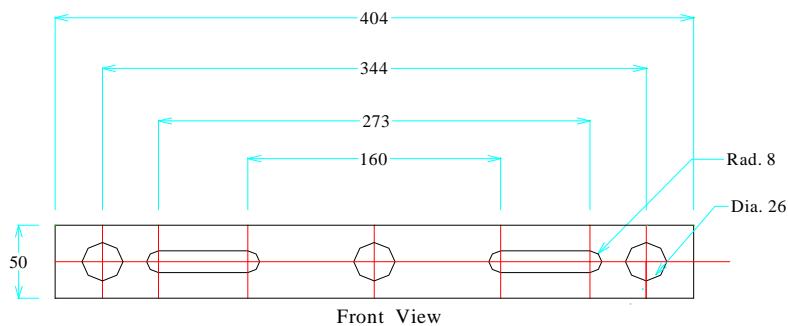
Clamps PC (TC) 1,2 Each ONE for this structure.

Note :- Dimensions are subject to approval prior to manufacture.

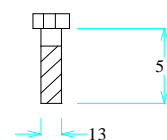
NEPAL ELECTRICITY AUTHORITY

All Dimension in mm	Off Set Cross Arm Assembly for 11 kV  DWG. 5H	Drawn by		
		Checked by		
		Approved by		

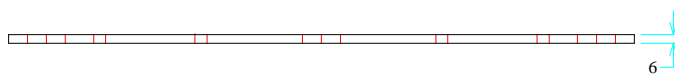
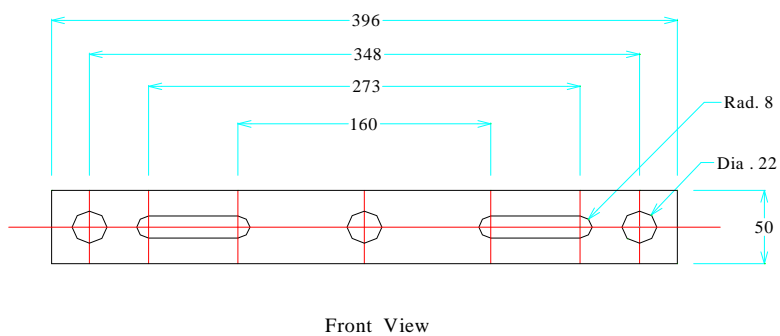
Strap for 33 kV Pin Insulator String.(404 x 50 x 6 mm)



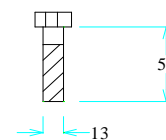
N/B 13 X 51 mm



Strap for 11 kV Pin Insulator String ( 396 x 50 x 6 mm).



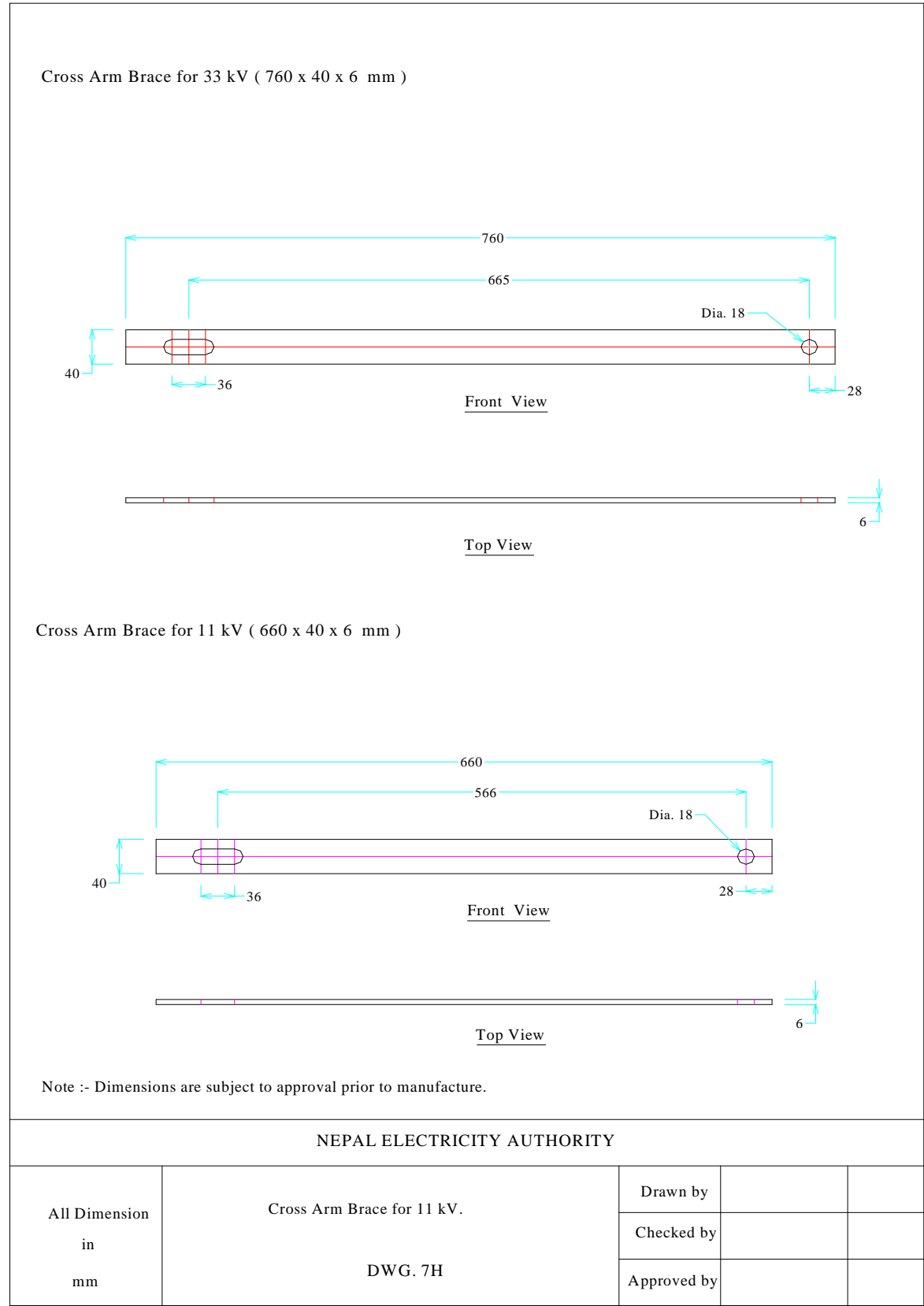
N/B 13 X 51 mm



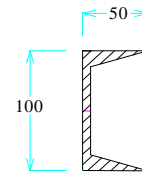
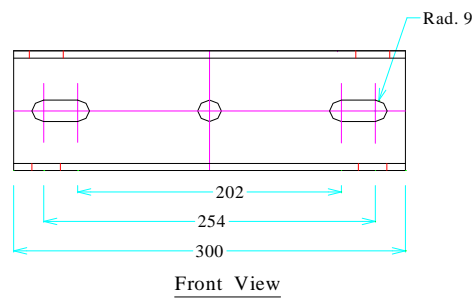
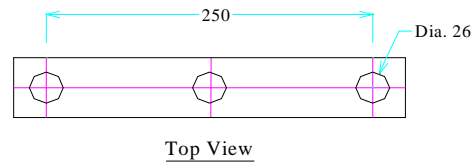
Note :- Dimensions are subject to approval prior to manufacture.

NEPAL ELECTRICITY AUTHORITY

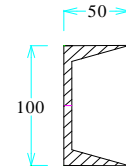
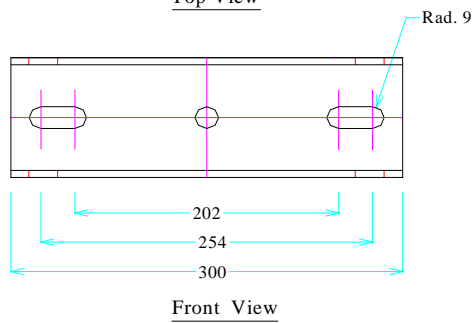
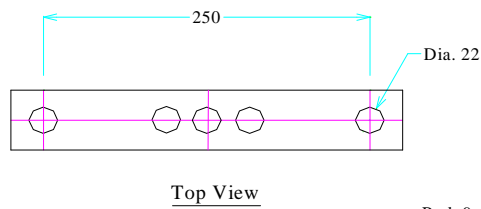
All Dimension in mm	Strap for Pin Insulator string ( 11 kV )  DWG. 6H	Drawn by		
		Checked by		
		Approved by		



Cross Arm for 33 kV ( 300 x 100 x 50 x 7.5 mm )



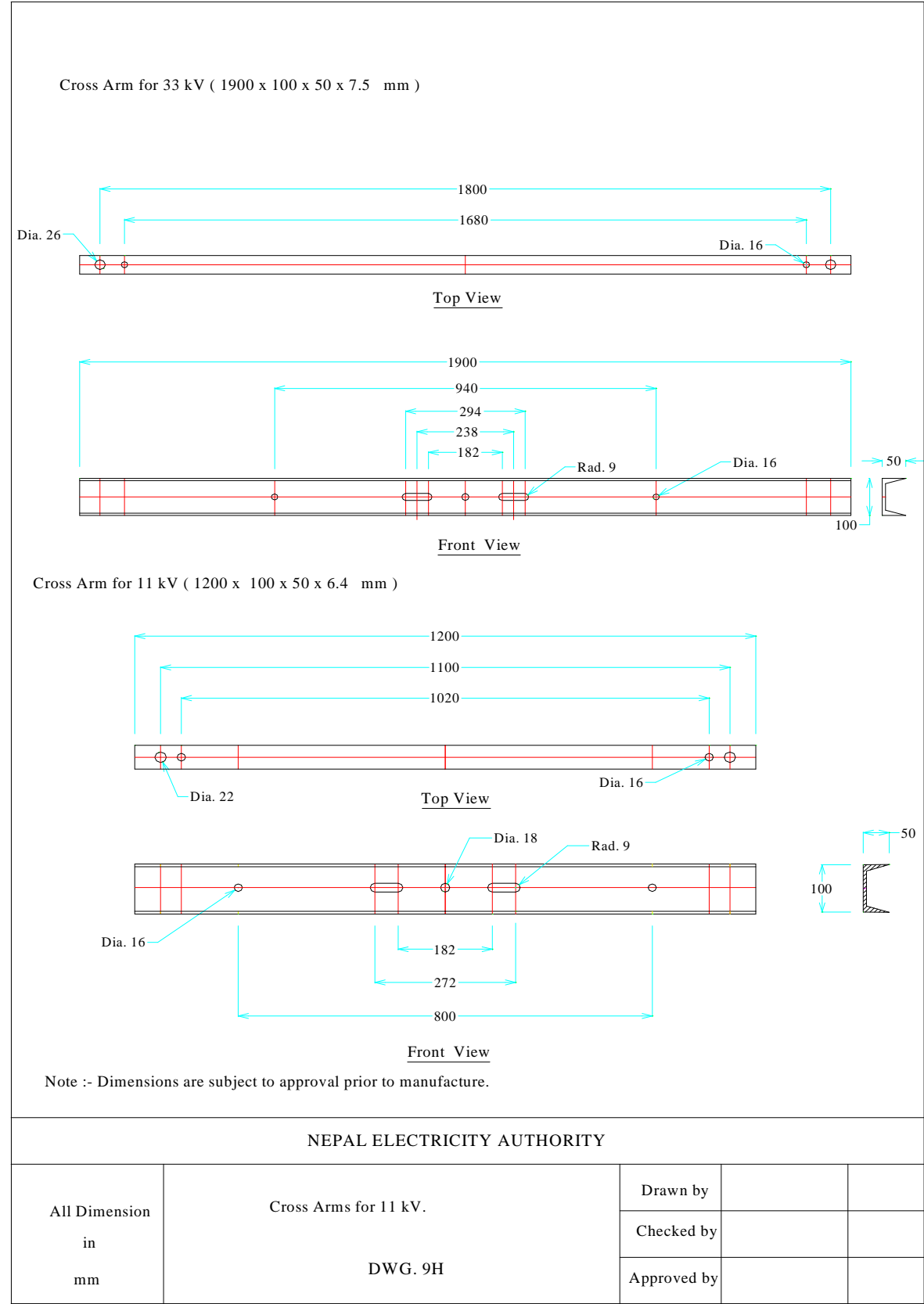
Cross Arm for 11 kV ( 300 x 100 x 50 x 6.4 mm )



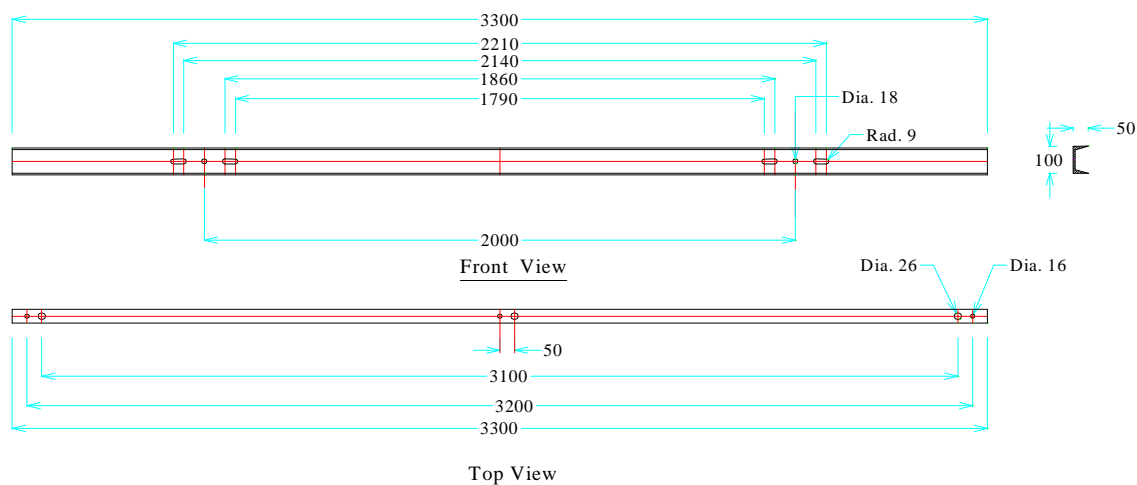
Note :- Dimensions are subject to approval prior to manufacture.

NEPAL ELECTRICITY AUTHORITY

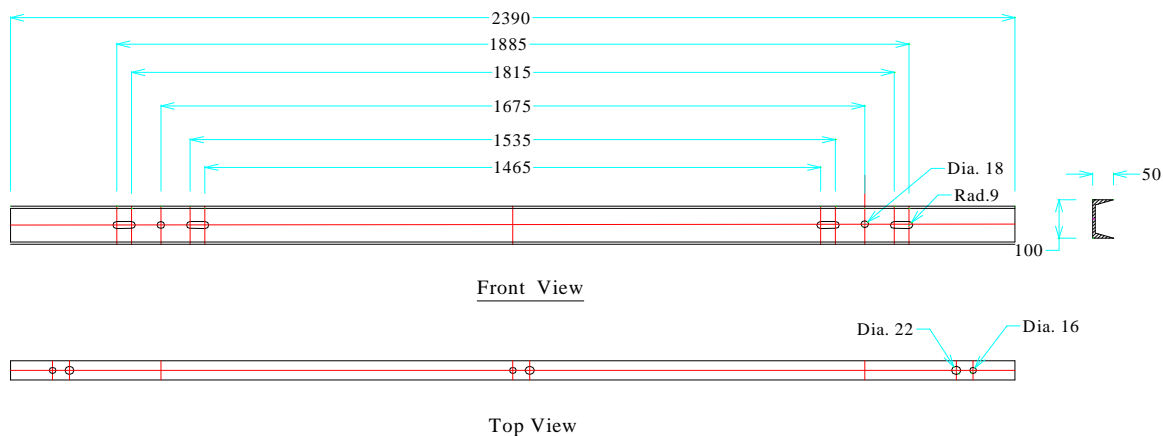
All Dimension in mm	Cross Arms for 11 kV.  DWG. 8H	Drawn by		
		Checked by		
		Approved by		



Cross Arm for 33 kV H-Pole (3300 x 100 x 50 x 7.5 mm )



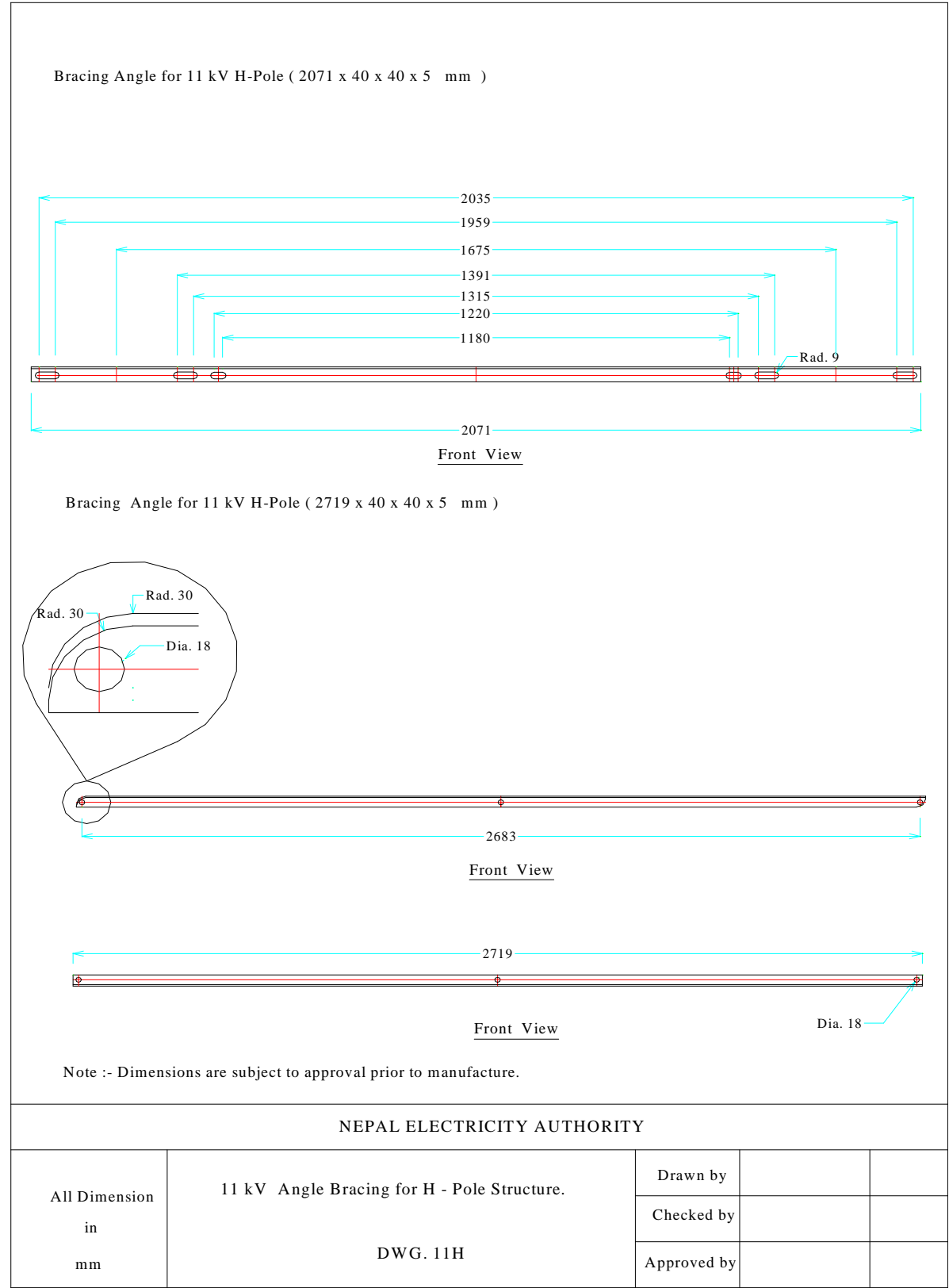
Cross Arm for 11 kV H-Pole ( 2390 x 100 x 50 x 6.4 mm )



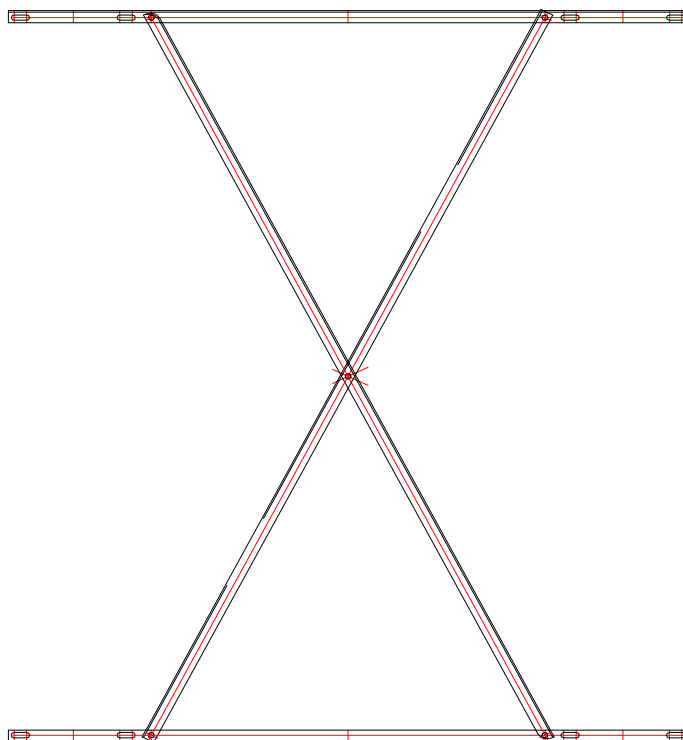
Note :- Dimensions are subject to approval prior to manufacture.

#### NEPAL ELECTRICITY AUTHORITY

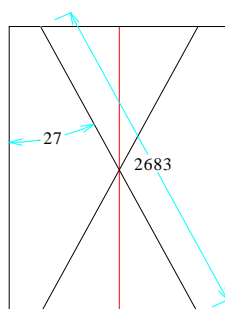
All Dimension in mm	Cross Arms for 11 kV H - Pole Structure.  DWG. 10H	Drawn by		
		Checked by		
		Approved by		



11 kV H- Pole Cross Bracing



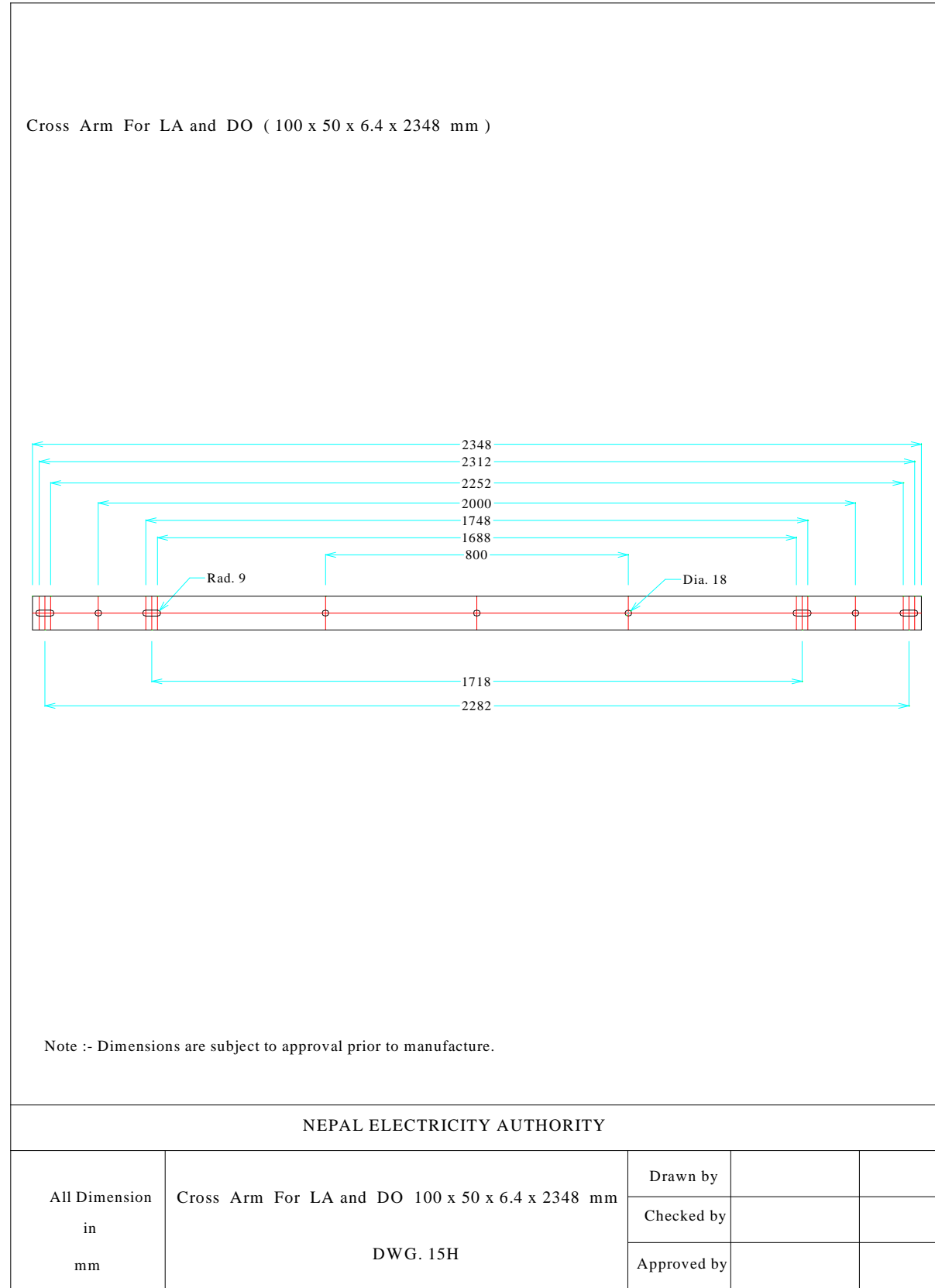
Front View

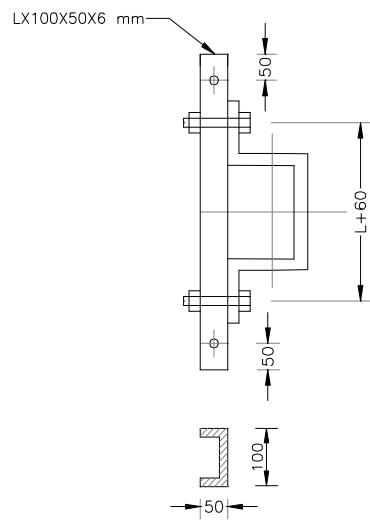
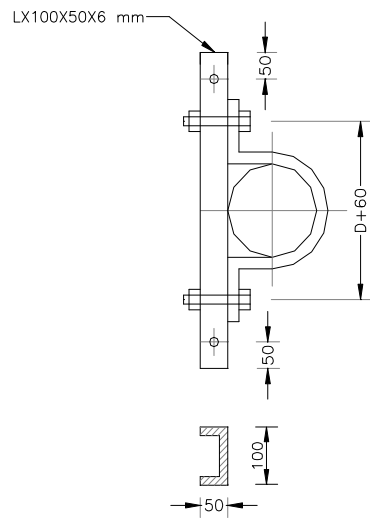


Note :- Dimensions are subject to approval prior to manufacture.

NEPAL ELECTRICITY AUTHORITY

All Dimension in mm	11 kV Angle Bracing Assembly for H - Pole Structure.  DWG. 12H	Drawn by		
		Checked by		
		Approved by		

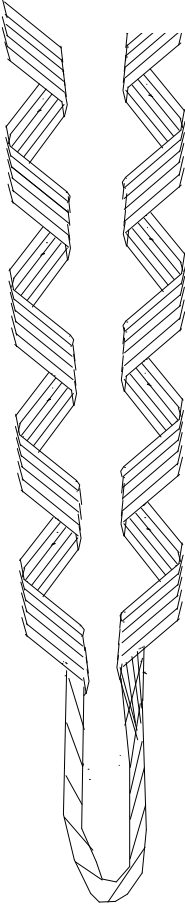


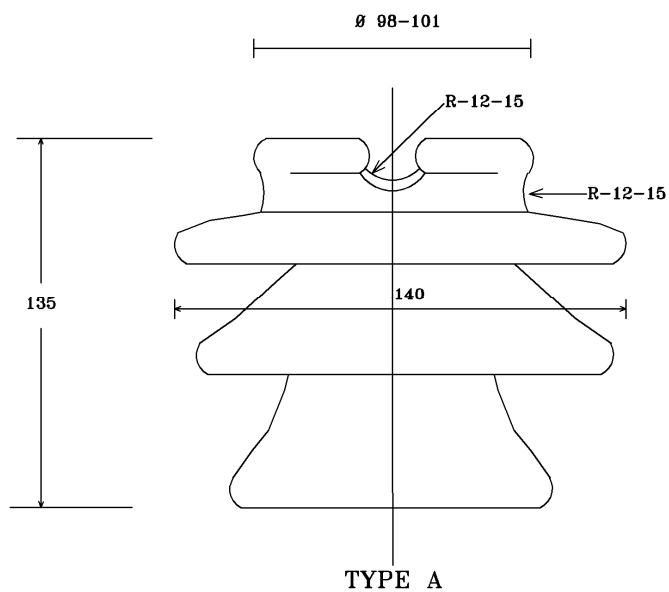


DRAWING NO.

POLE CLAMP

NEPAL ELECTRICITY AUTHORITY

		
DRAWING NO.	PREFORMED WIRE PRODUCTS	NEPAL ELECTRICITY AUTHORITY

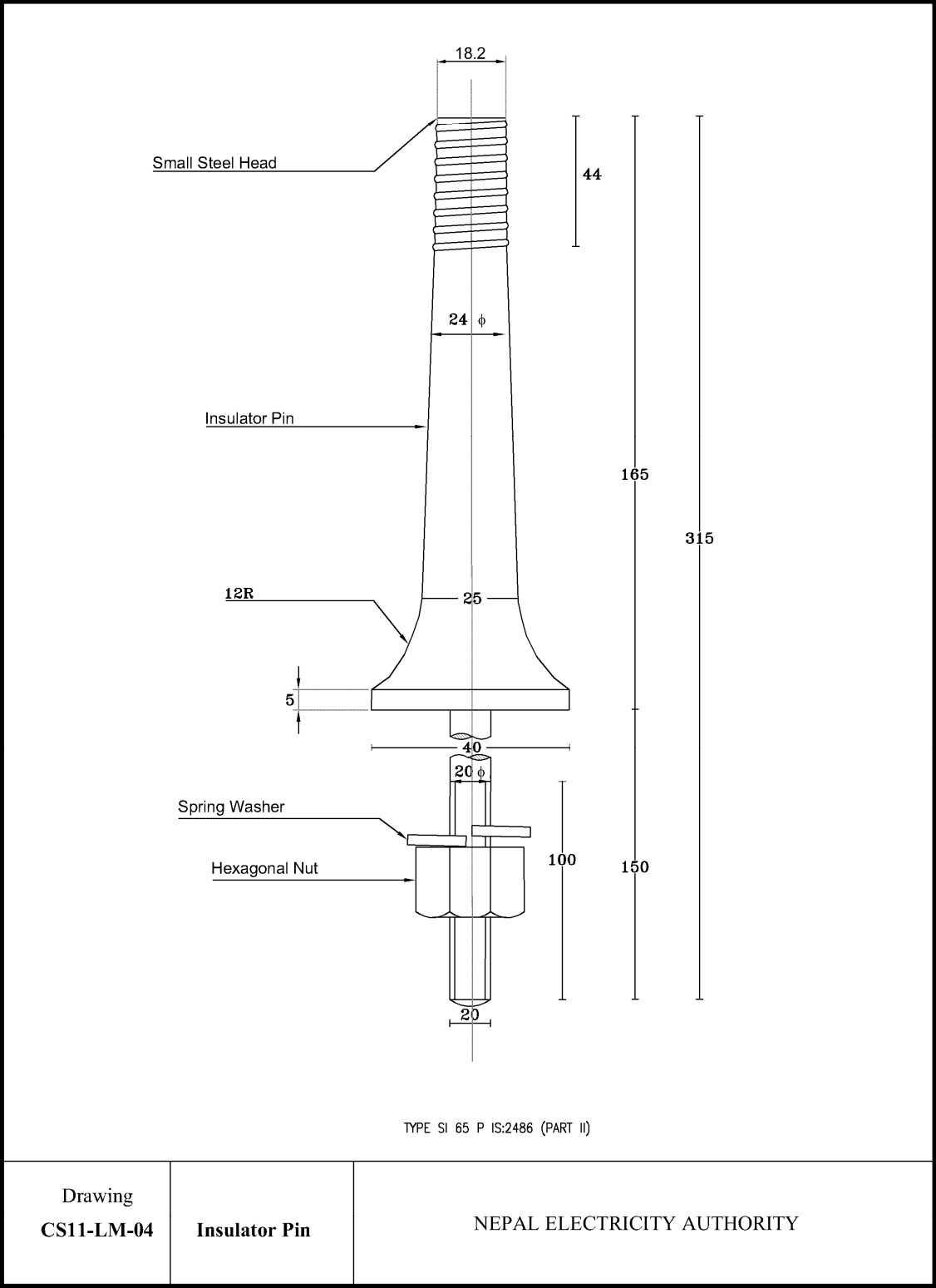


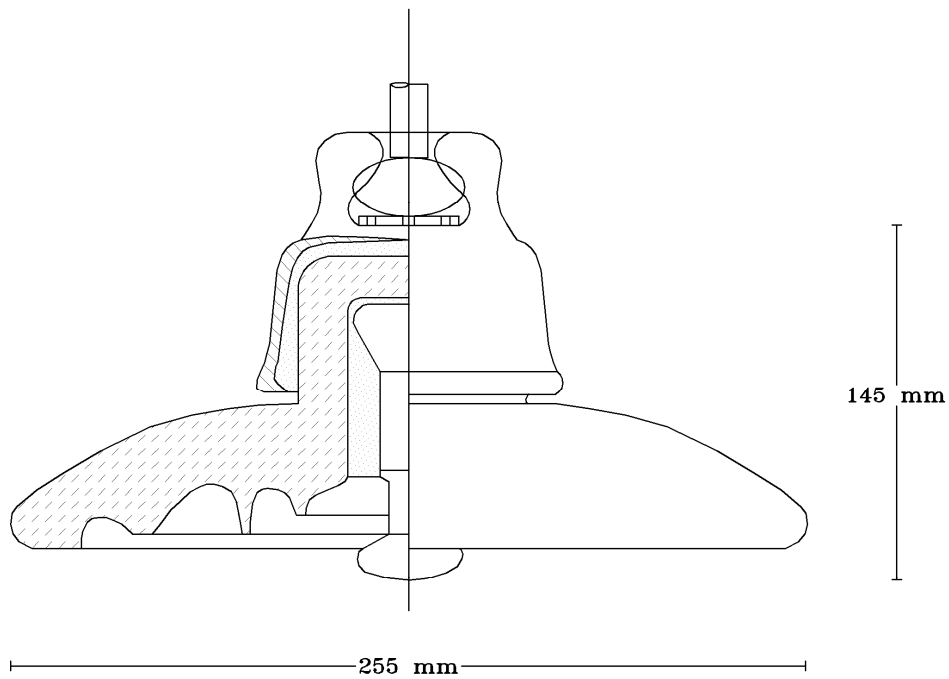
Applicable Standard IS : 731

Drawing  
CS11-LM-01

11 kV Pin Insulator

NEPAL ELECTRICITY AUTHORITY



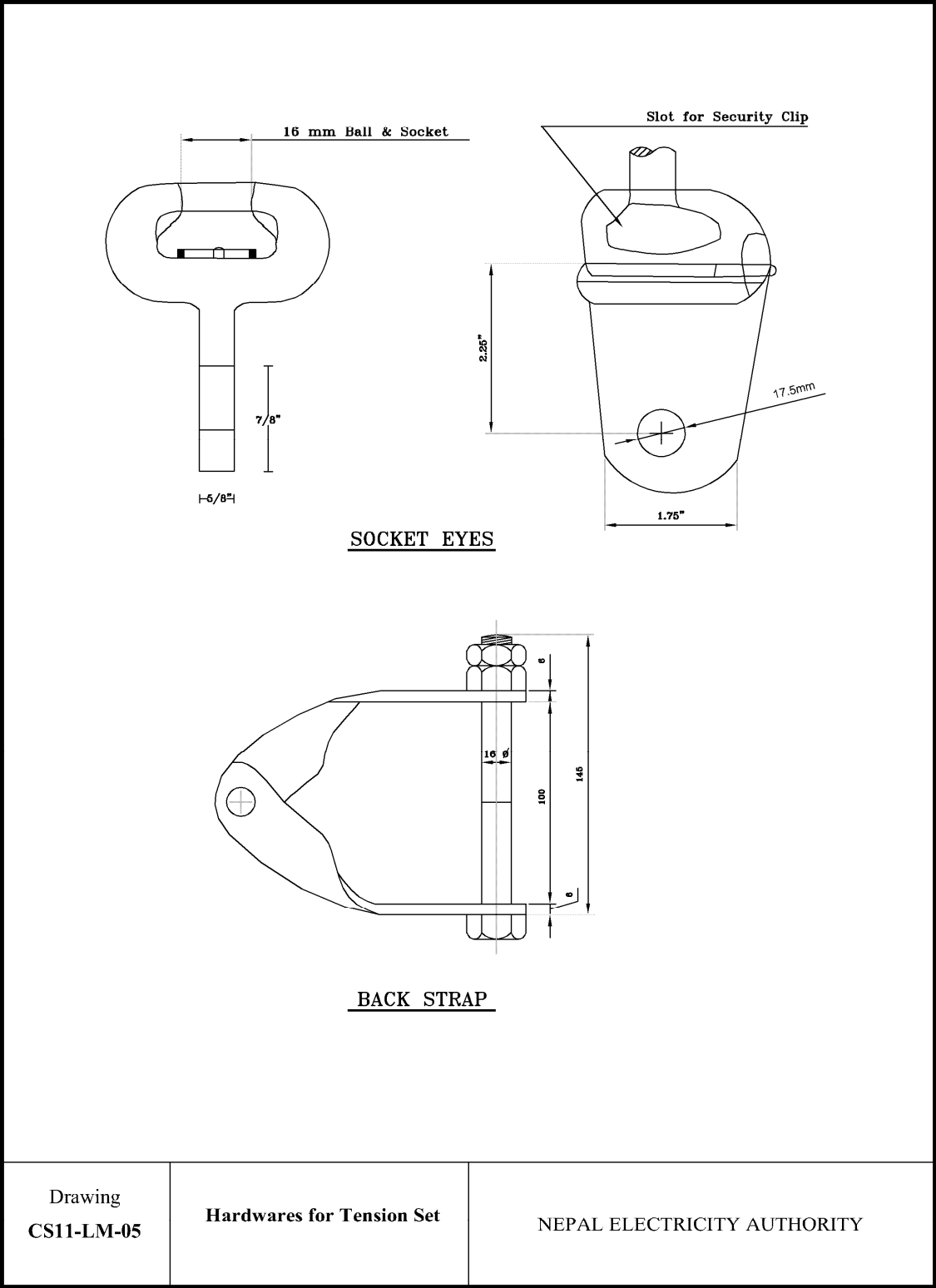


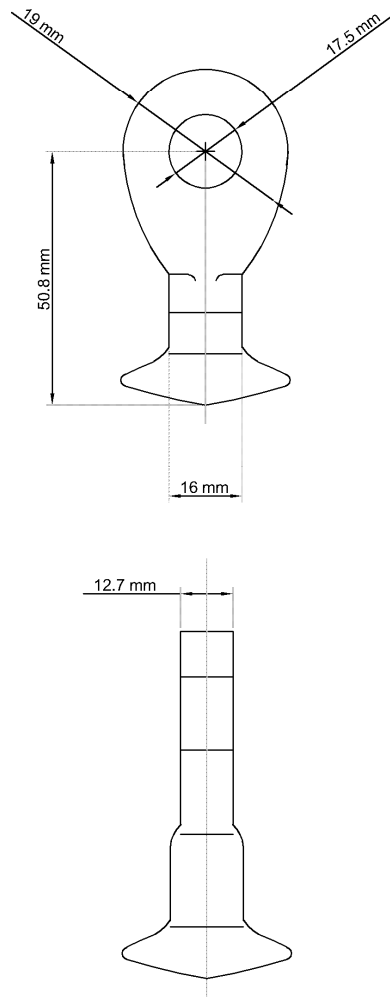
Applicable Standard IS : 731 & IS : 3188

Drawing  
CS11-LM-02

**Disc Insulator**

NEPAL ELECTRICITY AUTHORITY



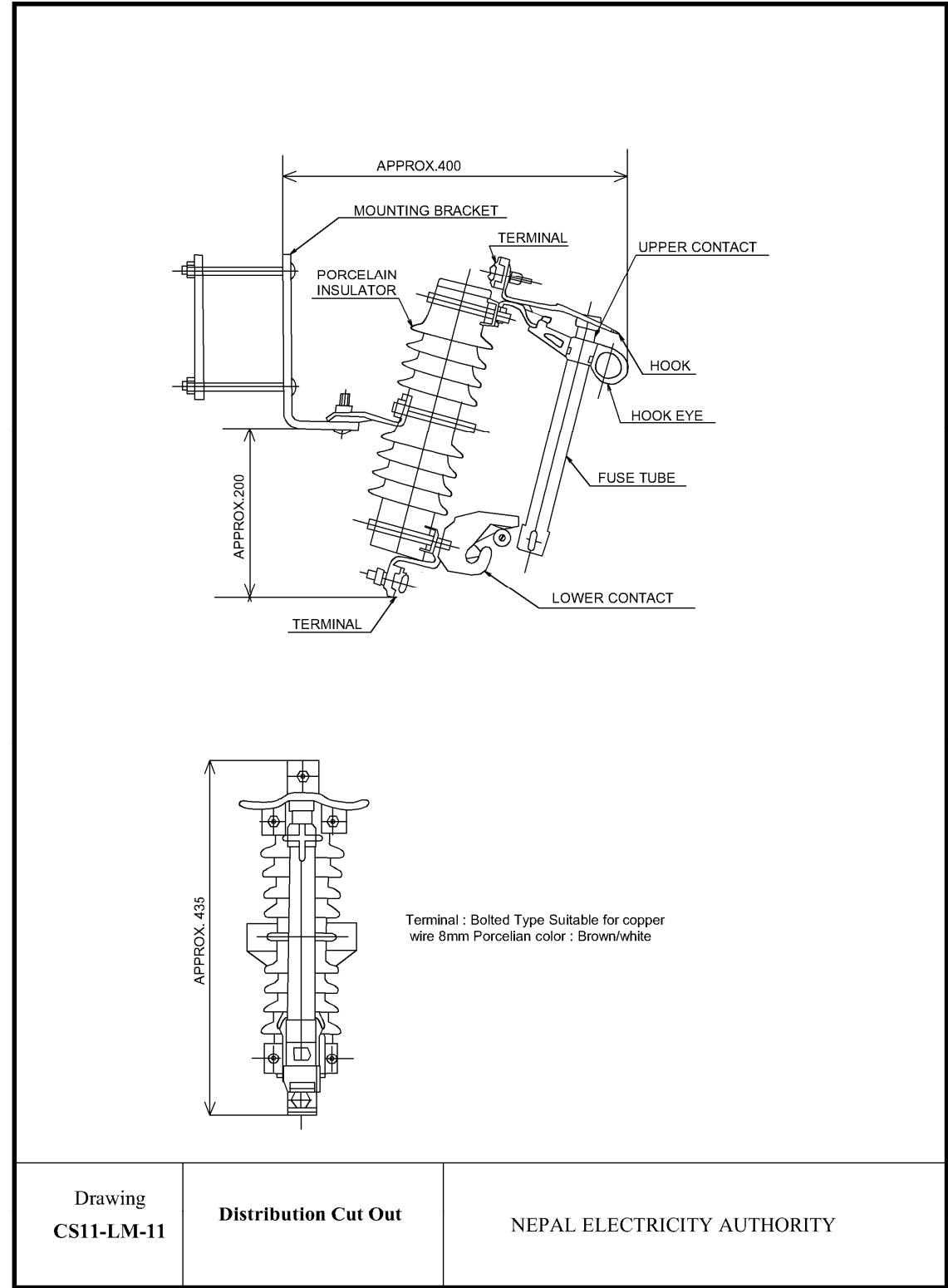


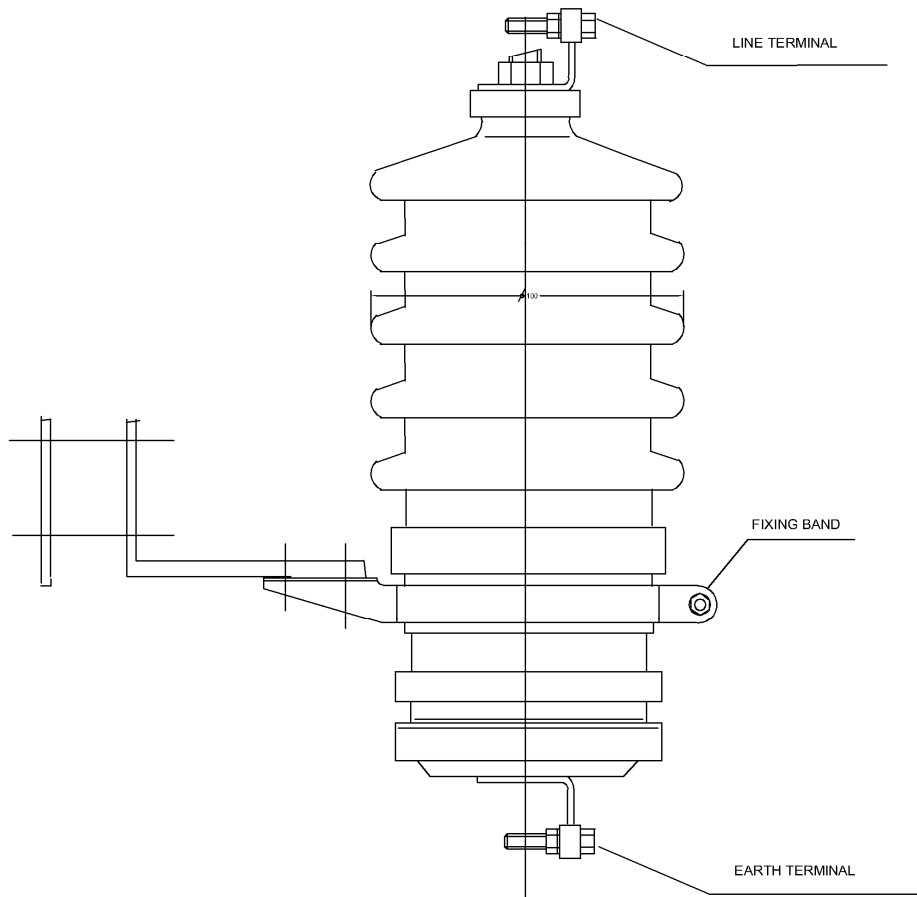
BALL EYES

Drawing  
CS11-LM-06

Hardwares for Tension Set

NEPAL ELECTRICITY AUTHORITY





Drawing  
CS11-LM-12

**Lightning Arrester**

NEPAL ELECTRICITY AUTHORITY